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Autor: Fricke, Beate

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Thinking in Spheres – The Curvature, the Horizon and Pictorial Space on the Feldbach Altarpiece, c. 1460*

by Beate Fricke

One of the oldest preserved representations of the earth's curvature can be found on a little-known altarpiece now in the Historisches Museum in Frauenfeld (Ill. 1 and Ill. 2).¹ The work came to the Museum of Frauenfeld after the Cistercian convent of Feldbach, located at the shore of Lake Constance, was dissolved in 1848. Jana Lucas has recently suggested that it came from St. Katharinental in Diessenhofen, a village located at the Rhine east of Schaffhausen.² The Dominican nunnery was dedicated to St. Catherine, where both Johns were prominently vener-

ated, which resonates well with the choice of saints represented on the central panel.³ The Feldbach convent was located close to the Swiss city of Steckborn, on a peninsula in the Untersee, the smaller of the two lakes forming Lake Constance. The altarpiece's central panel shows Christ with outstretched arms nailed to the cross above a high horizon. The combination of the cross's horizontal bar and the upward curvature of Christ's arms highlights the downward curve of the earth's surface. Below, at about the eye-level of the beholder, the large heads and



Ill. 1 Feldbach altar, c. 1460. Mixed technique on spruce, 138 × 131 cm. Frauenfeld, Historisches Museum Thurgau, Inv. 117.



III. 2 Feldbach altar, left and right wing, inner view, wings: 133.5 × 52 cm.

hands of the figures flanking Christ (John the Baptist, his mother, John the Evangelist and St. Catherine) form strong horizontal lines that further enhance the curving horizon in the depths of the picture plane.

This view of the earth's surface receding into a rounded horizon, made manifest through the scaled rendering of the ships (Ill. 3), is actually impossible from the vantage point of the beholder. Such a view can only be glimpsed

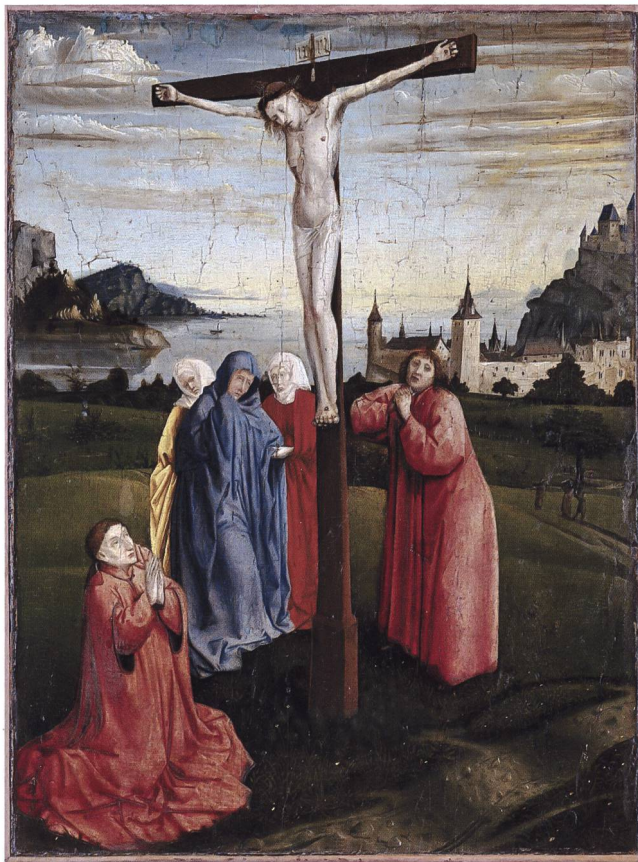
from a very high elevation, with a large expanse of the horizon visible.

The painter's choice of a sea coast as a background for the crucifixion might therefore come as a surprise. It is true that Upper Rhenish, Netherlandish and Italian painters, in particular Van Eyck and Konrad Witz, had already sought ways to represent the most distant horizon in Crucifixion scenes (Ill. 4).⁴ However, in the case of the



III. 3 Feldbach altar, crucifixion, detail.

Feldbach altarpiece the artist's decision to paint an open sea as backdrop for the crucifixion instead of the contour of a distant city was unusual and may well have been motivated by an interest in representing the earth's curva-



III. 4 Crucifixion, attributed to Konrad Witz, dated 1444. Oil on wood panel, transferred to canvas, 34 × 26 cm. Berlin, Staatliche Museen zu Berlin-Preussischer Kulturbesitz, Inv. 1656.

ture. A preliminary drawing that shines through the overpainting indicates that the artist had initially planned to depict a continuous cityscape, but ultimately abandoned this plan in favour of an aquatic landscape in which the representation of the earth's curvature plays a remarkably conspicuous role.

The spatial aspects of the relationship between the cosmos created by God and the pictorial formulas that artists invented in order to depict it reveal how artists were thinking about the relation between the visible and the invisible, earth and the divine sphere, and the imagination and the pictorial plane. God's creation finds reiteration in pictorial invention, which itself was an act of creation that sliced a segment out of the visible world and made it spatially manifest on the picture plane. The intimate relationship between the perception of space and the artistic use of colour in its representation – what Lorenz Dittmann has described as “building a spatial relief, with interacting colour zones” – shows that the rise of geometrical perspective, artistic experiments regarding the representation of the horizon, the observation of optical phenomena and the artistic use of colour perspective were intrinsically related.⁵ These pictorial developments do not derive from mutually exclusive principles, but instead from interrelated artistic experiments in cities and regions where, over the course of the two centuries before the Feldbach altarpiece was painted, natural philosophers had contributed their thoughts to an intensive discourse on the creation of the cosmos and the relationship of the macrocosm to the microcosm, between the divine Creator and his creation. Ideas and knowledge about the moving spheres that were thought to surround the world were transmitted in the abstract form of diagrams, which inspired speculation, imagination and extension. These images encouraged the notion of the earth's surface as the outer boundary of a sphere. The multivalent experimental

exploration of the spheres of the earth and the cosmos in images and natural philosophy can be detected, I suggest, in the Feldbach altarpiece, but this line of inquiry has yet to be explored in depth. This paper will examine the ways in which the Feldbach altarpiece connects ideas about temporality and causality, as well as visibility and invisibility, in a manner that hinges on the specific ways in which the artist treats the horizon line as a curve. Furthermore, the altarpiece emphasizes the interesting dissonance between the rectilinear pictorial format that predominates in that period and the curves and spheres pictured in paintings and diagrams of the cosmos in manuscripts.

State of Research: Along the Rhine to Utrecht?

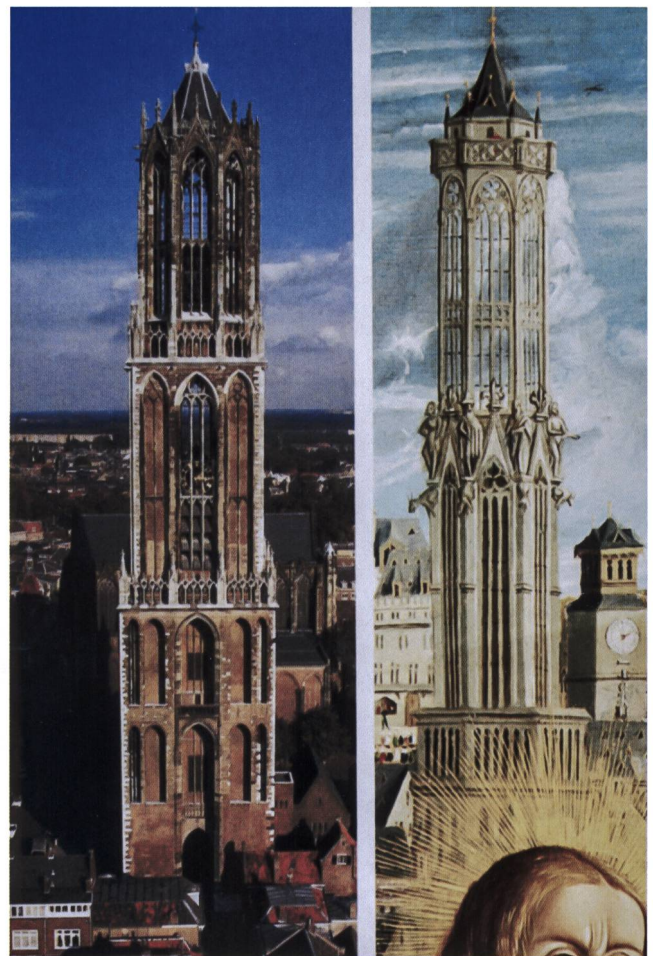
The extant scholarship on the Feldbach altarpiece consists of a dozen pages in print. As mentioned, the work came from the convent of Feldbach after it was dissolved in 1848. However, we do not know who the painter was, where the altarpiece was made, nor whether it was actually painted for the Steckborn convent in Feldbach. Based on stylistic analogies to upper Rhenish paintings from the middle of the fifteenth century, especially to works by Konrad Witz, it is presumed that the altarpiece was painted after 1450.⁶ In 1460 the patronage for the Steckborn monastery switched from the landgraviate of Thurgau to the confederate cities, so one could perhaps speculate that this change might have resulted in the commission of a new altarpiece for the early Gothic, Cistercian convent church at Steckborn.⁷

Bernd Konrad has described the significant change made in the background (from cityscape to maritime scene) of the main panel and discussed further details of the underdrawings revealed in the x-rays.⁸ Bodo Brinkmann, Madeleine Witzig and Uta Feldges-Henning have analyzed the close relationship between the Feldbach altarpiece and works by Konrad Witz, to which the nearest connections can be drawn. Since nothing is known about the painter of the Feldbach altarpiece, continuing along these comparative lines of inquiry are crucial for our understanding of the artist's background and interests. Inquiry into the two artists' works clearly reveals that both share a strong interest in representing a host of details characterizing every day life, from contraptions hung below windows to dry underwear to an usually insightful use of light and shadow. More uniquely, both painters demonstrate a close attention to the depiction of chromatic light effects; for instance, both apply the correct array of the colour spectrum for various occasions during night and day. Comparing the Feldbach painter's work to works by other artists can sharpen our understanding of his method.

As suggested by Bodo Brinkmann, Marcus Dekiert and Madeleine Witzig, the unknown artist's work reveals

strong roots in upper Rhenish traditions, yet his work also shows that he was deeply inspired by other places and sources. It is assumed, for instance, that he travelled to Utrecht. For, as these scholars have pointed out, there are striking similarities between the tower in the Feldbach altarpiece and the St. Martin church at Utrecht (Ill. 5 and Ill. 6), as well as colour gradations similar to book illuminations made in Utrecht at the same time with depictions of the sky and certain cloud details. His work also suggests familiarity with manuscripts being made there around the middle of the fifteenth century (Ill. 7 and Ill. 8).⁹

Research of the past two decades has shown with increasing clarity that artists, even when stylistically rooted in a given region, like the painter of the Feldbach altarpiece, were more mobile and more widely travelled than previously believed.¹⁰ Given the analogies in the painting of natural phenomena in Flanders and the Upper Rhine and the close similarity to the church tower at Utrecht to that in the Feldbach altarpiece, it is evident that the painter of the altarpiece had connections to both regions and that the altarpiece's connections to both



Ill. 5 and 6 Utrecht, cathedral and Ill. 6 Feldbach altar, detail of middle panel, inner side.

regions stem from a fluid movement of artists and painters between these locations in this period.



III. 7 Hours of Catherine Cleves, MS M.917, St. Christopher Carrying the Christ Child (fol. 275r), The Master of Catherine Cleves, c. 1440. Manuscript illumination, 192 × 130 mm. New York, Pierpont Morgan Library (Purchased on the Belle da Costa Greene Fund with the assistance of the Fellows, 1963).



III. 8 Hours of Catherine Cleves, MS M.917, Tree Growing from Adam's Grave (fol. 97r), The Master of Catherine Cleves, c. 1440. Manuscript illumination, 192 × 130 mm. New York, Pierpont Morgan Library (Purchased on the Belle da Costa Greene Fund with the assistance of the Fellows, 1963).

The Feldbach Altarpiece and Konrad Witz

On the surface, comparing the Feldbach painter to Konrad Witz seems to be an iconographical endeavour. The closest similarities between the central panel of the Feldbach altarpiece (see Ill. 1) and the crucifixion by Witz (see Ill. 4) are revealed in the following details: The heavily draped vestments, the group assembled around the cross, the facial features and posture of the mother of Christ, the interest in optical phenomena and compositional strategies like the choice of the background and placement of the city at the edge of the middle ground. Yet one can also discern an interest in depicting the horizon that appears to be shared by both artists – a painterly act that, I suggest, should not only be considered as an aspect of style, but which also reveals specific epistemological interests.

Konrad Witz's panel with the crucifixion shows Christ at the cross, rising high above the horizon, while the remaining figures in the image – the three Marys, John, and a kneeling donor in the lower left corner – are depicted in the lower half of the panel. Witz emphasized the horizon by choosing to paint a large lake or a tongue of the sea reaching deep into a coastal landscape as a backdrop for his crucifixion. Steep walls and towers enclose a settlement to the right and a lone ship sails in the middle ground. Several reflections in the water's surface and the broad colour spectrum of light effects in the cloudy sky testify to Witz's interest in natural phenomena. The blueish streaks of land towards the horizon reveal the panel's pivotal role in what would later become a typical feature of Flemish landscapes: the use of colour perspective to enhance the spatial depth.¹¹

The comparison with Witz's crucifixion in Berlin reveals similarities between the artists' works, but differences as well. These differences include the frontal depiction of the tall figures of the saints in the foreground of the Feldbach altarpiece, whose large scale effectively inhibits the subtle gradation of depth encountered in Witz's panel. The large nude feet of the saints in the foreground of the Feldbach altarpiece, together with Adam's skull and Catherine's broken wheel, prevent the beholder from "entering" the space depicted in the background. Konrad Witz, on the other hand, eases imaginary travel into the depicted site by offering the viewer a pathway right at the centre of the image's lower edge. Following the path the beholder's eye passes the cross; further into the middle ground the beholder encounters a group of three wanderers moving towards the settlement in the middle ground. These paths connect the fore- with the middleground and lead the viewer towards the horizon.

A number of studies conclude that Konrad Witz's optical interests are a consequence of his "verism" and his powers of observation: "Konrad Witz traces the ascent of bubbles from a murky shore ground, ascertains refraction in a staff plunged into water, and bequeathes us a view of Lake Geneva which, even today, can be used to determine

the artist's standpoint as it was painted in 1444."¹² But can naturalism in the depiction of littoral bubbles, refraction of light in water and a lake vista be reduced to a single artistic agenda and to the artist's singular powers of observation? Or should one not suspect a confluence of other factors?

Recent research has established that there was a common inclination among artists in Flanders and the Upper Rhine to develop painting styles that adequately represented the complexities of optical phenomena such as the projection of shadows and refraction in water, or the colouration of the sky. De Mey has analyzed, for instance, how Jan van Eyck combined the "representation of external and internal reflection".¹³ He points out van Eyck's combination of optical reflection and refraction, the mirroring of light entering a body of water or crystal, and its deflection therein – phenomena that were investigated,

understood and described in writings on optics taken from ancient Persian and Arabic science. These texts began to circulate in Europe at the end of the twelfth century, but were most intensively received during the thirteenth century and at the turn of the fourteenth.¹⁴ The innovative rendering of optical phenomena in the works of Konrad Witz (who travelled widely, including to Northern Italy) and fifteenth-century Flemish painters (whose works were highly sought after and traded in Italy) has repeatedly been presented by researchers as practical knowledge and a demonstration of their unusual artistic capabilities.¹⁵ Yet their expertise and insights do not simply originate in artistic practice but indicate a reception of encyclopedic texts, which had been disseminated in vernacular versions since the thirteenth century. Robert Grosseteste and Dietrich of Freiberg, scholars whose writings on the rainbow (*De iride*) were extremely wide-



III. 9 St. Christophorus by Konrad Witz, c.1435. Mixed technique on oak, 101,5 × 81 cm. Basel, Kunstmuseum Basel (Bequest of Friedrich August La Roche-Burckhardt 1868).

spread,¹⁶ describe experiments with a prism that have effects similar to the phenomena depicted by Konrad Witz, Jan van Eyck or the master of the Feldbach altarpiece. The quasi-scientific experimentation of artists striving to reproduce optical phenomena was not exclusively Flemish but could also be observed further up the Rhine, as attested by the *Hours of Catherine of Cleves* from Utrecht (see Ill. 7 and Ill. 8), the *Hours of Louis* (Savoy) and other paintings by Konrad Witz (Ill. 9).

However, van Eyck and Konrad Witz were not natural philosophers, whose artistic experiments served only to demonstrate optical principles. Witz's Christopher panel represents an optical reality (see Ill. 9) that is different from optical principles described in scholarly texts. But at moments the two converge, resulting in unusual painterly developments. It was the apprehension of space in full depth and the influence of light on the appearance of bod-

ies that the painter found most interesting in the newly acquired way of looking at the things surrounding him in the world of natural philosophy.¹⁷ The scholarly tracts explaining optical phenomena convey knowledge about the invisible.¹⁸ Such unseen phenomena are rendered visible in the paintings, even though, in part, they cannot be seen by the naked eye. This intersection of knowing, seeing and not seeing – and the resulting problem of depicting knowledge, seen or unseen – was made manifest in pictorial compositions by panel painters like Witz. This encounter of experienced knowledge and descriptions of optical phenomena results in precise epistemological negotiations in the context of manuscripts illuminated at the shores of the Lower Rhine.

Less well known are miniatures in encyclopedic manuscripts (Ill. 10), which show a clear painterly interest in representing the element of water. These manuscripts all



Ill. 10 Le Livre des propriétés des choses de Bartholomeus Anglicus, MS fr 134, De l'hydrographie (fol. 208v), Jehan Corbechon, c. 1480. Manuscript illumination, 90–115 × 85–95 mm. Paris, Bibliothèque nationale de France.

contain Bartholomew of England's *Livre de Proprietes choses* and were made just one or two decades later than the Feldbach altarpiece.¹⁹ Especially in the illustrations of one of these (BnF Ms fr. 134), one can observe a similar attention to the depictions of distant mountains and sophisticated reflections in the water close to the human figures (see Ill. 10). Rocky hills and bare trees are reflected in the clear lake water filling the middle ground; a small ship with three men on board is even placed so that it does not impinge on the reflections of the hills and trees, which are clearly visible in the blue waters. The two men in the foreground are actually looking at and explaining what they see, while the ripples made by the dripping water create a rich pattern of reflections in the shallows next to their feet. (Konrad Witz's panels had gained special renown just a decade earlier for depicting the phenomenon in this way.)

In the case of the Feldbach altarpiece, the artist's attention to the refraction of light is revealed in the representation of the moon's halo and the light pillar in the upper left scene. The light pillar are the vertical bands of lights which appears to extend above and below the moon, created by the reflection of ice crystals suspended in the atmosphere. In these details one recognizes the painter's careful observation and depiction of the spectral colours at dusk and dawn in both scenes of the panel's right wing. One also discerns this in the representation of the refraction and reflection of light in crystals as described by Robert Grosseteste and Dietrich Freiberg in their tracts on the rainbow, and the transparent cloth of the risen Christ, which complements the painter's interest in indicating specific times of day.²⁰ These detailed depictions of optical phenomena often appear in paintings and manuscript illumination in combination with the choice of a high horizon, allowing the painter to enhance the picture's depth with additional use of colour perspective for the landscape.²¹

Pictorial Reflections about Viewpoints and the World's Surface

Despite the fact that Witz gives the beholder more 'access' to the depicted background, the Feldbach artist paradoxically gives the viewer more detail by making his background so distant and thus providing information about the topography of the landscape and the curvature of the earth. A number of pictorial details – aside from the horizon line itself – strengthen the notion that an interest in rendering the horizon and thinking about the shape of the earth was of great importance to the painter of the Feldbach altarpiece. Looking at the watery area to the right of Christ's torso in the central panel, the viewer finds a set of sailing ships heading toward the horizon, a movement indicated by their placement on the picture plane behind Christ. First, at the level of Christ's waist, the beholder encounters a sumptuous ship with billowing sails. At breast level, two more double-masted ships are sailing at a greater distance from the viewer. They are correspond-

ingly reduced in size. These two ships are each more or less half as large as the first. Between these smaller two, some four further sailing boats can be detected. The ship at the far left is the most remote of the group and the second from the left is the nearest, while the remaining two recede backwards in carefully graded steps of decreasing size (see Ill. 3). Why has the artist included this procession of sailboats, so carefully attended to in disposition and scale? Why this unlikely backdrop to the crucifixion, which is quite unique?

Of course, one must think not only about the central panel's message, but also the altarpiece as a whole, and when considering its opened wings, the earth's curvature seems to be of utmost importance.²² On both wings, one observes various passion scenes related to times of day that correspond to the sky's rotation, or the earth's rotation from a modern point of view. The four scenes on the inner sides of the wings (see Ill. 2) frame the event at the core (see Ill. 1). On the upper left wing, Christ is praying at night at the Mount of Olives; below the beholder sees him carrying the cross at Jerusalem in daylight. On the upper right wing the entombment is shown at dusk; below the resurrection at dawn (see Ill. 2). Looking at the altarpiece with its wings opened, the beholder thus encounters the depicted scenes of the passion not only at specific sites, but also at specific times of the day. When the wings are closed, the spectator is invited into interiors in which the artist presents saints holding their attributes, but without specification of location or time.²³ The saints appear on a patterned floor, indicating the low depth of the interior space with the vanishing lines of the floor tiles.²⁴ Inner and outer wings thereby present a marked contrast: The outer wings show saints embedded in interiors with no further temporal or spatial dimension, while opening the altarpiece reveals perspectives upon the four cardinal directions at different times of the day and provides insights even into the invisible dimensions of the cosmos, e.g. the rotation of the earth, implied by the artist in the arcing horizon and the details of the ships.

A closer look at the details in the background of all five inner panels, i.e., the parts of the work more likely to be chosen by the artist rather than the patron, reveal the anonymous painter's particular interest in optical phenomena. The choice of background stands in contrast to the conventional rendering of the saints in the foreground, indicating an interest in representing the optical and physical experience of the immediate world. The saints, though conventionally depicted, inhabit a world filled with perceptual details that the viewer shares. The core panel offers a wide view of a coastal landscape behind the heads of four saints standing under the crucified Savior's outstretched arms. To the left, a truncated cityscape features a splendid Gothic tower, while to the right of the city, we are presented with a vista of a sea or a large lake bustling with sailing ships. The ships resemble those with which sailors from Spain, Portugal or Genoa used to ply the open

ocean as opposed to the types of boats that sailed the upper Rhine on Lake Constance.²⁵ Some of these ships even fly a crescent moon flag (the same emblem to be found atop the tower) providing evidence that the painter was up-to-date on geopolitical trends of his time, like the westward expansion of the Ottoman Empire. But why has he so conspicuously included the procession of ships in a crucifixion scene?

Sacrobosco's Ships and the Seeing and the Blind Eye

I suggest that the artist's attention to the ships and their placement both relative to one another and to the horizon evidences knowledge that the painter would have gained either at university or from private study of writings about the shape of the earth, such as Johannes de Sacrobosco's widely circulated *De sphaera mundi* or any of several commentaries quoting, revising or expanding his study, such as tracts by Bernard of Le Treille (d. 1292), Michael Scot (d. c. 1234), John Peckham (d. 1292) and Pierre d'Ailly (d. 1420), or translations of *De sphaera mundi* into the vernacular, e.g. by Konrad von Megenberg (d. 1374).²⁶ Sacrobosco's treatise, often accompanied by illustrated diagrams, was used in teaching with armillary spheres and was available in several vernacular translations. The particular manuscript included here was illuminated in Basel in the 1430s and reveals striking similarities regarding the design of the ships we find in the Feldbach altarpiece (Ill. 11).²⁷ The red lines connecting the eyes of the sailor sitting at the top of the ship's mast with the tower at the green shore emphasize that the sailor at the bottom at the mast does not see what the elevated sailor above him can see from his raised position. Sailing away from the shore, the upper figure can see the tower longer than the sailor can from his position at the bottom of the mast. This is because the curvature of the earth blocks the lower sailor's sight more quickly than that of his "seeing" colleague. The lower red line, thus, hits the ocean's surface and does not reach the tower, which underscores that the sailor standing below no longer sees that what the one above him can perceive.

The argument that the painter was familiar with such astronomical treatises is corroborated not only by this one detail, but by several aspects in the altarpiece that correspond to elements in Sacrobosco's text. These include: the sequence of five ships, with their gradual decrease in scale; the horizon's curvature; the positions of the seeing/not seeing sailors at the top and the bottom of a ship's mast, as well as differentiated optical phenomena related to different hours of the day, such as spectral colours at dusk and dawn and the eclipse during the passion.²⁸ The concurrence of these details strongly suggests that the painter either read Sacrobosco's treatise, or one of several commentaries on it, for only these texts address all of the enumerated details.

It is generally assumed that Sacrobosco's treatise *De sphaera mundi* (ca. 1230) was written (like the slightly older anonymous *Theorica planetarum*) for the education at the faculty of arts in Paris, and quickly found a broad audience.²⁹ Among other topics, Sacrobosco describes the eight spheres surrounding the earth, the movement of these spheres, and the sun. Furthermore, he mentions the earth's curvature, the eclipse at the time of Christ's death at the cross, and refers to the colour spectrum of light. I am not attempting to argue that the artist of the Feldbach altarpiece necessarily read Sacrobosco's text or one of its commentaries or translations in its entirety; rather, I aim to relate the religious painting to contemporaneously written and disseminated astronomical treatises in order to show that inspiration for religious arts came from a very specific corpus of well-known and well-understood secular texts.

Since Cleomedes in the Greek world and with Calcidius's Neoplatonic commentary on *Timaeus* in the Latin West, two principle observations about the shape of the earth had been brought forward by the time of the Feldbach altarpiece.³⁰ Firstly, an observer of a ship sailing towards the horizon still continues to see the ship's masts and sails after its hull has disappeared; and secondly, an observer at an elevated position can follow the progress of such a disappearing ship longer than an observer who stands at sea level, even if the two are the same distance from the ship.³¹ These are the arguments advanced by Aristotle when he proposed that the earth had a spherical form in his *De caelo*.³² This work became particularly popular following the intensification of the reception of his writings in thirteenth-century Paris.³³ The first of these two arguments is also advanced both by Pliny in his *Historia Naturalis* and by Strabo in his *Geographica*.³⁴ Such was the scientific standpoint available to Johannes de Sacrobosco in the thirteenth century when he was writing his *Sphaera*. Sacrobosco explains the motions of the stars and the planets (including the sun and the moon) in relation to the still-standing earth and how those movements are seen from different positions on the earth's surface.

Sacrobosco, like Aristotle, inquires into the differences between the visual experiences of two observers located on the same ship, both of whom watch the same object on the shore, but from different heights: one high on the mast and the other at the mast's base.³⁵ His point is that the sphere of water surrounding the earth is also spherical, which was rendered visually explicit in diagrams made for manuscripts of Sacrobosco's texts addressing this experience.³⁶ In the manuscript containing Sacrobosco's text at Oxford, a contrast is drawn between the "blind" eye at the base of the mast and the "seeing" eye at its summit, both focused upon the same red mark.³⁷ The "seeing eye", elevated and looking from the top of the ship (*oculus existentis in summitate*) versus the "blind" eye at the bottom (*oculus in pede mali*) are given particular emphasis with red inscriptions in another manuscript of Sacrobosco's text,



preserved at Lyon (see Ill. 12) and illuminated around 1430 in Basel.³⁸

Comparison of these diagrams with the Feldbach altarpiece reveals striking similarities. The artist and the author are both interested in the effect of the curvature and how that impacts the beholder's ability to gain insight into what lies near or beneath the horizon. These concerns are manifest in many minute details of the Feldbach altarpiece; when looking closer at the ship to the right of the crucified Christ's waist, a man in the ship's high crow's nest can be discerned, pointing to land beyond, whereas

his red-clothed colleague lower on deck does not (yet) see what he sees (Ill. 11). Vision from a high vantage point is further referenced in the painting's overall composition and the way in which the beholder is involved in the painting's structure, viewing the scenes from a raised position and therefore seeing Christ not at ground level looking up from below at a tilted angle but on the cross in full frontality. The beholder is able to look down towards the items spread out in the foreground, and can, at the same time, see clearly above the standing saints' heads. A presumed eyelevel at the height of the saint's head places



III. 12 Feldbach altar, middle panel, ships, detail.

the viewer at a slightly elevated vantage point. From the chosen point of view above the saints' heads towards the horizon, a close observer sees the curved surface of both the earth and the painting in an almost diagrammatic way.

Behind the saints, the puffed sails of a good half dozen ships indicate their passage from the coast towards the horizon. This directional emphasis and the elevated standpoint of the altarpiece's observer draw attention to the fact that the hull of the most distant ship is almost completely invisible. Of the ship in the farthest distance, only a smear of brown can be discerned under the brilliant white of its mainsails. This is quite different from the depiction of the other ships as they move nearer in space and time to the land-based observer. The wooden hulls of the ships closer to the viewer are clearly recognizable underneath their curved sails. These details show a striking correspondence with Sacrobosco's text and the diagrams created by manuscript illuminators to illustrate his thesis. By deploying these details in this manner, the artist indicates that the viewer of the Feldbach altarpiece is positioned as a "seeing" viewer, like the sailor on top of the mast. The beholder has risen to an impossible position at the shore, as if looking from above upon the disproportionately large

saints' feet in the foreground and at the same time seeing above their heads towards the horizon, from which vantage point the viewer can also make out the earth's curvature.

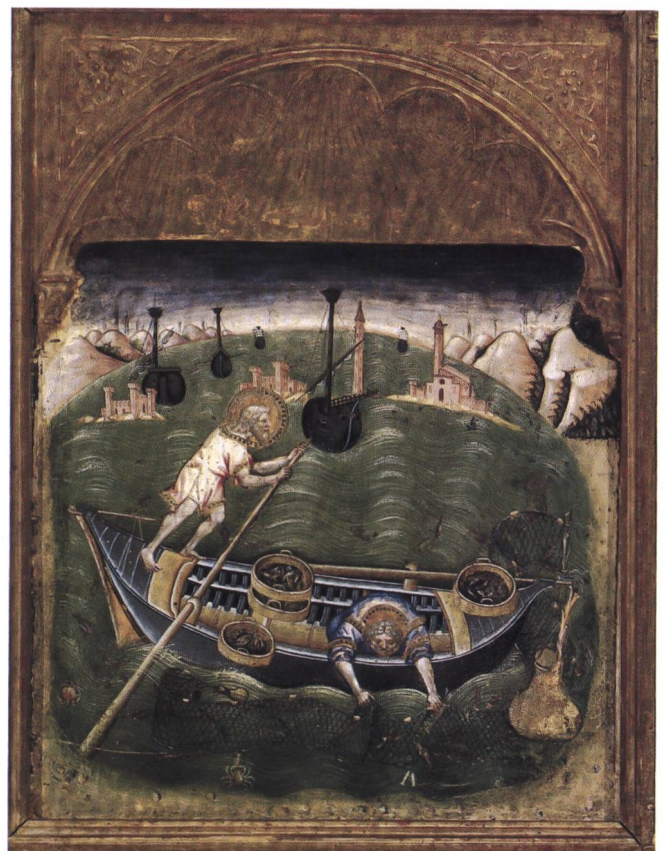
Two early translations of the treatise into Middle High German were especially widespread.³⁹ There are ten different known versions of the two translations, one of which is by Konrad von Megenberg, the translator of another famous and widely disseminated encyclopedic text, *On the Nature of Things*. The other is *The Book of Nature* by Thomas Cantimpre, which includes 33 chapters on the cosmos, heaven, the seven planets and also astronomy and meteorology. Both Sacrobosco's and Cantimpre's texts are the basis for diagrammatic representations of the spheres surrounding the earth, to which this article will turn shortly.⁴⁰ The close connections between Sacrobosco's text (or its commentaries and translations), its illustrations and the Feldbach altarpiece is particularly evident on comparing these changes of visible aspects of ships sailing on water at a certain distance with the lonely ship on the Berlin panel of the crucifixion, attributed to Konrad Witz (see Ill. 4). Here the beholder sees the vessel from an elevated position, but remains clearly positioned below the

line of the horizon in relation to the elements in the middle and the foreground of the picture. The horizon in the panel in Berlin is an even line and just a barely discernible difference in colour, marking the zone in which the surface of the sea gleaming in the sunshine and the glowing heavens seem to merge atmospherically. In the Feldbach altarpiece, the horizon appears as a curved line as opposed to an even line with atmospheric perspective. It therefore seems more to resemble contemporary diagrammatic illustrations of the earth as a circle, accompanied with two lines, one dissecting a portion of the circle to describe what the “blind” sailor sees, and one line connecting the seeing sailor with something he sees in a straight, uninterrupted line.

Based on these evident analogies between the Feldbach altarpiece and Sacrobosco’s text, it can be presumed that it was Sacrobosco’s treatise or a commentary on his text, which inspired the painter. The depiction of the curvature on the Feldbach altarpiece seems like a construction derived from Sacrobosco’s or one of his followers but the artist nonetheless combined this mode of representation with the atmospheric perspective in order to integrate the insights gained from the observation of optical phenomena in the world like light and colour. In this way, the object appears to depict the edge of the visible world in two complimentary manners at once.

Depicting the Curvature

Analyzing contemporaneous depictions of the earth’s curvature sharpens our understanding of the Feldbach painter’s reliance on Sacrobosco’s text. A group of Italian panels, predella panels originating from two different altars made just before the turn of the second half of the fifteenth century, show a similar background – the open sea – with a slightly curved horizon (Ill. 13). However, these panels do not reveal any direct connections to Sacrobosco’s text. In all three scenes painted for the predella of the Madonna del Pergolato, by Giovanni di Pier Matteo (Boccati) for the oratory of the confraternity of the Disciplinati di San Domenico at Perugia in 1447, the beholder encounters the open sea as a background for the the figure of Christ at various narrative moments: his capture, carrying the cross and the crucifixion (Ill. 14, Ill. 15, and Ill. 16). In all three panels the horizon line appears curved. While no ship sails on the sea behind the Roman soldiers and the apostles in the garden of Gethsemane and only a small sprinkling of islands are spread out behind the crucifixion, a group of boats does accompany the movement of Christ carrying the cross to Mount Calvary. Five boats of differing sizes appear behind Christ. The staggering of their scale underscores the long distance between the twelve boats harboured in the city’s walled port and the horizon. Yet while



Ill. 13 Altarpiece of Saints Peter and Paul by Jacopello del Fiore and follower, 1439-1443. Denver Art Museum.

the depiction of ships serves here to mark a passage in space and time, the way in which they are rendered manifests no relationship to Sacrobosco's text. In this image, no figure points from the top of the mast and no sailor stands at the base of the mast. Here, the relative sizes of the vessels may indicate a general spatial recession, but the artist does not draw the viewer's attention to the ways in which visual experience of the horizon functions in relation to the height at which an individual perceives the earth's edge.

An initial conclusion may be drawn on the basis of these comparisons. While the horizon becomes a subject – albeit infrequent – depicted by Italian painters around 1450, the contemporary Feldbach altarpiece, painted by an artist north of the Alps, is a unique example of a work that combines a depiction of the earth's curvature with evidence that indicates the painter's knowledge of Sacrobosco's widely disseminated tract on the spheres. The Italian painters of the predellas mentioned above show no direct inspiration from Sacrobosco's lines explaining the movement of the sun or the earth. The predellas include no pictorial references to the blind and the seeing eye as described by Sacrobosco, nor do they show a sequence of ships diminishing in size towards the horizon. An interesting case is the alterpiece of Saints Peter and Paul, painted by Jacobello del Fiore and follower in the years 1439–43 (see Ill. 13). Here the sequence of ships is depicted below the curved line of the horizon, but in this case as well, we can only speculate about the potential connections between the master of the Feldbach altarpiece and Jacobello del Fiore.⁴¹ As Laurinda Dixon has shown in her discussion of Giovanni di Paolo's *Expulsion from Paradise*, the diagram of the cosmos was informed by Sacrobosco's *Sphaera mundi*. In another painting, in his Baptist predella showing St. John retiring to the desert (Ill. 17), now in London's National Gallery, the painter, who was familiar with Sacrobosco's text, also included a curved horizon.⁴² However, it is unlikely that such examples were known in the Upper Rhine in the mid-fifteenth century. Although Konrad Witz travelled to the Savoyan region, we have no further evidence for direct contact regarding the painter of the Feldbach altar. We have to presume that either the two painters were independently inspired from reading Sacrobosco's text and thus included the depiction of the curvature, or that an unknown connection, be it a person, a painting, an illumination or a drawing, which no longer exist and left no traces, circulated between the two painters.

These pictorial experiments explored a deeply contested field of knowledge at the time when the Feldbach altarpiece was painted. The desire to reach out to see what lies behind the horizon and to climb to heights that would enable mankind to see above and beyond the horizon was considered a heretical enterprise in the medieval era.⁴³ As Honorius Augustodunensis put it, no man has the power to penetrate the horizon and see through the entire aerial



Ill. 14 Captivity of Christ, Predella Madonna del Pergolato by Giovanni di Pier Matteo (Boccati), 1447. Tempera on panel. Perugia, Galleria Nazionale dell'Umbria, Inv. 151.



Ill. 15 Christ Carrying the Cross, predella Madonna del Pergolato by Giovanni di Pier Matteo (Boccati), 1447. Tempera on panel. Perugia, Galleria Nazionale dell'Umbria, Inv. 151.



Ill. 16 Crucifixion, predella Madonna del Pergolato by Giovanni di Pier Matteo (Boccati), 1447. Tempera on Panel. Perugia, Galleria Nazionale dell'Umbria, Inv. 151.

sphere since the Lord is gone and clouds hide him from our sight.⁴⁴ Theologians argued that the horizon was the line that demarcated the difference between the (limited) human ability to perceive the world and Christ's ability

to see (and oversee) the entire cosmos.⁴⁵ This perhaps explains, or would certainly seem to correspond to, the apparent reluctance on the part of painters in the high Middle Ages, to depict human heads extending above the line of the horizon. Peter Krüger argues that more than a century before Alberti's description of perspectival projection with the famous window-metaphor, the principle of the 'window' had already been applied in painting.⁴⁶ Imagining a painting as a segment of the visible world, seen by a viewer standing in front of a window, would result in the horizon as a straight line, since the beholder is neither elevated enough to actually see the curvature of the horizon, nor is the visible part of the world wide enough to actually allow a view upon a curved horizon. To gain such a sight the beholder would need to rise closer to the sky and leave the terrestrial realm – seeing the curvature is only possible from heights above an altitude of 10,000 m.

As always, there is also another story to be told in relation to this artistic narrative of perspectival representation. North of the Alps, a parallel, if not interlaced development unfolded in relation to the horizon. Looking again at the Feldbach altarpiece with its wings open, only Christ's head is depicted protruding above the horizon in the first and the last scene, while in the main central panel, both his chest and head rise above the earth's curvature. All other heads remain below the horizon, as we have just observed in Italian examples. The notion that the horizon line is not otherwise to be crossed seems to gain further traction with the depiction of blood dripping from the upper cross beam toward the saints standing below. This draws attention to the picture plane of the altarpiece, down which the blood seems to be dribbling. It is almost as if the narrative scene could be understood as lying behind the invisible surface of an imagined screen, behind Alberti's (glass-less) window, dividing the beholder from the world of the painting. Not even the saints' shining

halos, which distinguish the figures clearly from the landscape painted behind them, cross the terrestrial boundary into the sky that envelops Christ (see Ill. 1 and Ill. 3). On one hand, the Feldbach altarpiece thus echoes the prescription against extending beyond the horizon; on the other hand, however, it courts the potential danger of transgressing the horizon line and exploring what lies behind it by placing one of the sailors close to it on the top of his ship's mast.

Composition, Knowledge and Observation: Perspective and the Pictorial Plane

Interest into acquiring insight into what lies beyond the horizon of the visible world is clearly manifested in diagrams and depictions of the visible and invisible parts of the cosmos in illuminated manuscripts of encyclopedic writings from this period. However, comparing panel paintings is not enough to learn more about the potential motivations of an unknown painter. A broader comparison to other pictorial forms, manuscripts and tracts may provide a better understanding of how certain pictorial solutions or innovations might have emerged within the overlapping context of natural philosophy, manuscript illumination, theology and artistic conventions of representing the world.

Several decades ago, Svetlana Alpers suggested that two modes of representation are central to Western Art. In the first, the Albertian model, "The artist is a viewer who is actively looking out at objects – preferably human figures – in space, figures whose appearance, considered as a matter of size is a function of their distance from their viewer."⁴⁷ In the case of the Feldbach altarpiece, this viewer would focus on the figures, like those gathered around Christ at the cross, perceiving the group at a single glance. The artist then invites the viewer to zoom into the painting's depths and study details such as optical phenomena, or tiny prosaic elements like laundry hanging out to dry. One element acts as a contextual and literal frame for the other. The second mode of pictorial representation according to Alpers is "not a window but rather a surface onto which an image of the world casts itself, just as light focussed through a lens forms a picture on the retina of the eye." In this second mode, the frame is obsolete, the world produces its own image, one not framed by the artist.⁴⁸ In the Feldbach altarpiece, this second mode is embedded into the very same panel, which simultaneously deploys the first mode in order to represent the world as framed, not unbounded. It is the painter's choice of details in the background that reveals his knowledge of the natural world: the curvature, the various times of the day, the difference between refracted and reflected light. These details make the painter's representation of his own, physically experienced world tangible for the beholder. At the same time, the artist embeds these within



Ill. 17 Saint John retiring to the Desert, predella panel from an altarpiece by Giovanni di Paolo, 1454. Tempera on panel, 30.5 × 49 cm. London, National Gallery, NG5454.

the other image, the narrative of the passion scenes that are distinct from this temporal and physical experience. This article does not aim to replace the metaphor of the picture as a window with one of a world represented according to an increasingly contingent system of perspectival modes. Instead, works like the Feldbach altarpiece themselves point to a coexistence of the Alberti window with other modes of representation. Instead of Alpers' dichotomy of perspective versus surface, the painter of the Feldbach altarpiece reveals, in his combination of different modes of representation, cosmological knowledge based on diagrams in manuscripts of scholarly treatises and relates it to spatial/perspectival forms of representation (and knowledge). One might therefore conclude that, prior to the existence of two clearly distinct modes of representation in the Early Modern period, one finds a combination of various modes of perceiving and representing the world. This coexistence undermines modern classifications of pictorial representation into neat categories. A modern viewer used to seeing pictures that adhere to either the one or the other mode of representation is particularly confused when both modes are present in the same picture, as in the painterly experiments by the master of the Feldbach altarpiece and Flemish painters in the fifteenth century. In the Feldbach altarpiece, the horizon line becomes a touchpoint in which we can detect the ways in which overlapping modes of representation commingle in one image.

In painting, the deployment of linear perspective, the (straight) horizon or *linea centrica* as Alberti calls it, is a constructed element; it is neither a diagrammatic feature nor a perceptual phenomenon.⁴⁹ Linear perspective exists in an enclosed pictorial world; it does not imply the existence of a "beyond" outside of its own pictorial construction. It remains locked within a contained world in which infinity is "measurable", an aspect of linear perspective that points to the science of the seventeenth century, as Hubert Damisch has observed.⁵⁰ As Hans Aurenhammer has revealed, although Alberti speaks of the horizon in other parts of his tracts as a line at which earth and heaven seem to meet, he does not connect it with the *linea centrica* when he describes the drawing of a horizontal line through the focal point (*punctus centricus*) as the final step in composing a representation according to the rules of linear perspective.⁵¹

What this article may contribute to this comprehensive discussion is just a small detail regarding a specific moment in the long history of perspective in painting, namely, the enduring hesitation to pictorially explore the known, but unseen, or to put it differently, to explore what "knowing" and knowledge added to "seeing" and pictorial representation for a small group of Flemish painters and illuminators working in the first two decades after the middle of the fifteenth century in the area around Utrecht. In painting the Feldbach altarpiece, the artist combines knowledge based on direct visual experience and

knowledge based on conceptual modelling or diagrammatic mapping—although those latter forms of knowledge themselves often derived from interpreting what is visible.⁵²

The intersection of "knowing" and "seeing" produces a desire to not just show depth but also surface, as well as the intersection between the two – i.e., how a depiction interested in representing surfaces allows the viewer to have a *diagrammatic* view of the scene at hand in a manner that paradoxically emphasizes the distant and unseen (as, for example, in diagrams in Sacrobosco's treatise that illustrate diverging sailors' points of view depending on their relative positions on a mast). One can interpret the painter of the Feldbach altarpiece's play with *turning* the orientation of the beholder on the five different panels of the opened altar as a reference to the importance of observation and knowing for true insights into the world. This painterly play with rotating the orientation and perspective as if it were moving the gaze together with the heaven's rotating movement is emphasized in the altarpiece through the celestial phenomena visible at different moments of the day.

In this period, we can observe a related change in the development of medieval cartography. Like illuminations in manuscripts, panel paintings of world maps such as the Walsperger World Map created in 1448 at Constance integrate diagrammatic and increasingly naturalistic or "perspectival" features (Ill. 18).⁵³ The Walsperger chart, measuring 57.5 cm, is surrounded by the spheres and oriented towards the south, as were most Islamic world maps in this period. The map combines mythological knowledge from chronicles such as Adam of Bremen or the Nuremberg Chronicle, mentions Ptolemy in the written paragraph at the bottom and represents South America prior to Columbus' voyages as suggested by Paul Gallez.⁵⁴ Paradise is located in the east, in Asia, the information used by the monk from Salzburg combines a mixture of salvation accounts, reception of antique, islamic and Western medieval knowledge as well as contemporary geographical information.⁵⁵ As Tanja Michalsky suggests, one should understand the creation of space in pictures as an expression of a historically perceived space, in which human-kind defined both being in the world and being together.⁵⁶ Focusing on the early modern period, she links the revelation of concrete space with the relationships between objects in space, perceived by the beholder. For the late mediaeval beholder, I would go a step further and include things imagined by the beholder that lie beyond the terrestrial space articulated by the relationship between depicted objects. This implies an interest in configuring knowledge about what lies beyond the visible world. The divine world is, thus, also included in monumental maps such as the Ebsdorf map. The map, destroyed by fire in 1943, measured 357 cm in diameter, with Jerusalem at the centre, and included the head, hands and feet of God holding the worldly orb.⁵⁷ Like monumental *mappaemundi*, the



III. 18 Worldmap by Andreas Walsperger, Pal. lat. 1362 B, I448. Parchment, 73.5 × 59.5 cm. Vatican, Biblioteca Apostolica Vaticana.

Walsperger worldmap provides a basis for the assumption that cartographic models might have also been relevant for the painter of the Feldbach altarpiece. In both cases, the Ebsdorf map and the Feldbach Altarpiece, Christ seems to embrace the *orbis terrarum* and his passion seems to be shown as its spatio-temporal site, which orients mankind in the world.

Turning the Orientation: The Sky's Movement

In the Feldbach altarpiece, it was not simply interest in a naturalistic mode of representation that motivated the artist to depict the earth's curvature as a backdrop to a crucifixion scene (see Ill. 1). He understood the phenomenon of the curvature and he accompanied his depiction of the earth's curvature on the centre panel with demonstrations of refraction and of diverse scatterings of light in the sky at various times of the day. The upper subject of the left panel, a Gethsemane Prayer, shows a corona around the moon, a phenomenon caused by the diffraction of light in the water droplets borne by clouds (and distinct from the refraction at work in rainbows and celestial halos, see Ill. 2).⁵⁸ Underneath, twelve hours have passed: It is now midday. When comparing the depictions – above and below, left and right – on the inside wings of the altarpiece (see Ill. 2), it seems that in each case the observer's perspective has been rotated 180 degrees when moving from top to bottom to point in exactly the opposite direction (more on this detail below). On the left wing, the opposition of a natural setting (above) with an urban centre (below) underscores this reversal of direction; on the right wing, a Westernized "Jerusalem" appears as the backdrop on top, then disappears from view below.

On the upper part of the right wing, the artist has depicted the interior of a walled-in tomb and a doorway leading beyond those walls. Below, in the view to the east, this doorway carries an inscription across the lintel. The Entombment at the top right takes place at dusk on the day of preparation before the Sabbath, after Pilate has released Christ's body for burial before nightfall, as prescribed by Jewish law.⁵⁹ (This stipulation was so important, as Flavius Josephus mentions, that even criminals were buried before dark.) Dusk is caused by the scattering of light in the earth's atmosphere. Molecules of air and evaporated water scatter more blue light (with its shorter waves) than red light, such that during the daytime the canopy of the sky is blue, whereas towards the horizon, due to light's longer journey, reddish tones predominate.⁶⁰ The Resurrection, on the other hand, is shown at dawn, a fact stressed by the artist's representation of Christ's crystal flagstaff and diaphanous flag of salvation. Finally, the half-turn rotation in this scene is attested by a different decorative program on the side of the sarcophagus. The quatrefoils of the Entombment have been replaced in the Resurrection with

a fish-bladder motif and winding trefoils; the inscription is visible on the narrow end with the ornamental strip opposite. The observer of the Resurrection has thus travelled around the grave and now peers over it towards the place where he or she had stood during the Entombment. Christ himself, if imagined as still inside the sarcophagus, underneath the cover sealed with red lacquer, has thus been rotated 180 degrees relative to the observer.⁶¹ The turning of the orientation in each panel is another indication of the painter's interest in visually moving over the earth's surface and, simultaneously, of his understanding of how the (medieval) sky / (modern) earth's movement impacts perception – particularly if the viewer/artist is moving at the same time. Representing these visual clues in an altar panel as fruits of the painter's reflection about the earth's appearance from different positions of a (mobile) beholder is both intimately related to and only possible in paintings that rely on the coexistence of different modes of representation, as outlined above. It is the fluid movement between one mode and the other that conveys not only a preoccupation with these interests, but makes them tangible for the beholder as an integral part of the viewing experience.

"Turning" the orientation of the beholder is truly an exceptional feat, and one that becomes more clearly identifiable when comparing the Feldbach altar to contemporary depictions that contain similar elements but lack the Feldbach artist's sophistication in combining all details into a larger program that intends to convey insights into the movement of the sky and how its spherical rotation influences the earth's appearance at different times of the day. The only clock depicted in the altarpiece is mounted on the tower right next to the cathedral's bell tower but does not have a pointer yet, so indicates no precise time (see Ill. 5). It is one of the oldest extant depictions of a dial plate mounted on a highly visible tower at the centre of a city. The display of clocks in public space was a quite recent development at this time. It was followed by an increasing structuring of public life around the sounds of bells, which had been introduced into cities to provide citizens with access to "accurate" time over the course of the fifteenth century.⁶² Several Flemish manuscripts illuminated around 1470 show clocks mounted in urban centres (Ill. 19). On the page of a chronicle depicting John I. of Castile trying to conquer Lisbon in 1384, we find a combination of aforementioned details like the effect of light on wavy water, four ships in decreasing size towards the horizon and a clock mounted on the tower at the centre of the city.⁶³ In this case, however, the image was not inspired by reading Sacrobosco or observing nature, but clearly follows the artistic conventions of the time; we discern no references to the (invisible) parts of the bigger picture and the cosmos; no sailors are shown at the bottom and at the top of the same ship's mast.

Ill. 19 Chroniques sire Jehan
 Froissart, MS fr 2645, Battle of
 Lisbon (1384) (fol. 1r), Jean
 Froissart, c. 1470. Manuscript
 illumination. Paris,
 Bibliothèque national de
 France.

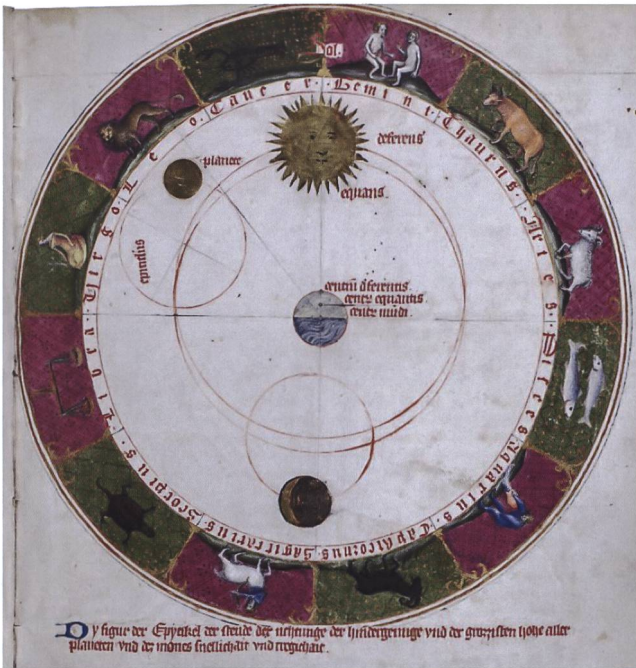


*Thinking in Spheres: Space, Time and Order
 of the Celestial Spheres*

Let us turn now to manuscript illuminations that reflect similar concerns. In manuscript versions of Sacrobosco's treatise on the spheres, one often encounters miniatures that combine different modes of representations (Ill. 20). These show, for instance, the signs of the zodiac as symbols that designate the outer sphere surrounding the cosmos represented as a diagram. The diagram encloses the earth at the centre and shows the paths of the sun, the moon and the planets as lines circling the earth on their individual courses. In other examples, these courses are represented within concentric spheres surrounding the earth, such as in the frontispiece of a Netherlandish *Historienbibel*, which dates from the same time as the Feldbach altarpiece (Ill. 21). Here, further layers of spheres in various colours demonstrate the constellation of concentric heavenly bodies. Beyond this realm, the reddish shading of the rows of angels above the cosmos causes the top half to appear like dawn or sunrise. In the bottom half, the circles of praying saints and blessed ones are placed against a blue background. Though the diagrammatic schemes differ between Sacrobosco's treatise and the *Historienbibel*,

the overall content and its placement remain the same, with striking similarities in the arrangement of the zodiac, sun, moon and planets.⁶⁴

What makes this Utrecht illumination particularly interesting for our discussion of representational strategies and depictions of the "invisible" parts of the cosmos is that the illuminator combines different modes of representation based upon both emulation and innovation: firstly, the *diagram* (inspired by those relating to Sacrobosco), secondly, the *spatially* depicted spheres surrounding the earth and last but not least, a *temporal* indicator with the colouration of the heavenly sphere referring to dusk or dawn. This gradation of the colour spectrum, with the red glow close to the horizon fading into the yellow of an already illuminated sky, and with the dark blue of night still showing at the lower edges, is not unique to the Feldbach altarpiece or the *Historienbibel*; the illustrator of the *Hours of Catherine of Cleves* was similarly inspired some years earlier. There the gradation is most manifest in the picture of the tree whose trunk is breaking through the covering of a sarcophagus at Adam's grave (or perhaps Golgotha) (see Ill. 8). In these three cases, a similar artistic intent has produced quite different results with respect to representation and the painter's use of the pictorial plane.



Ill. 20 De sphaera, MS M.722, geocentric diagram enclosed by circle of twelve panels for zodiac symbols (fol.18r), Johannes de Sacrobosco, c. 1425. Manuscript illumination. New York, Pierpont Morgan Library (purchased from Voynich in 1927).

In the Zoudenbalch *Historienbibel*, illuminated at Utrecht in 1460 (see Ill. 21), colour gradient also adds a spatial dimension. In comparison, the younger Netherlandish *Historienbibel* (Ill. 22) lacks the colour but includes the diagrammatic model for its representation of celestial space. In the Zoudenbalch *Historienbibel* (see Ill. 21), behind the lower half of the globe, the angels rotate between golden, white and pink garments set off against the dark blue background. The colours of the spheres indicating the courses of the planets are assigned different shades of blue (marked with gold contours) and green zones that denote the different angles of their trajectories. At the centre lie the earth and the four elements.

This contrast leads to another element foundational to understanding the experiments made by the painter of the Feldbach altarpiece around 1450: the rise of painters thinking about the cosmos in terms of nested spheres. By “thinking in spheres”, I mean the imaginary, playful treatment of the pictorial plane in representations of the cosmos, which was informed by an interest in observing how the positions of the horizon and the beholder could influence the representation and viewing experience of the subject matter. This involved the painter’s speculative reference to the (invisible) spheres surrounding the earth. In reference to paintings that include invisible spheres by combining different modes of representation in the same picture, Klaus Krüger writes of a “paradox of the perceptual situation into which the viewer is transposed, since both panels show something endlessly distant or

even things unseeable in a system of mimetic representation.” Krüger argues that the paradoxical viewing experience is caused by the dissociated and ambiguous relationship between physical perception and actual dimensions.⁶⁵

The inspiration for the representation of the cosmos as concentric spheres or rings – with the divine presence occupying the outermost ring – goes back to Ptolemy.⁶⁶ This practice probably originated in texts negotiating Platonic and Aristotelian ideas that circulated between the thirteenth and the fifteenth centuries, such as Gossuin de Metz’s treatise *L’image du Monde*. Several extant manuscripts illuminate de Metz’s text, even though many of its assumptions were either rejected by scholars or disproven soon after its writing. In a manuscript preserved in Paris (Ill. 23), concentric rings – with a reddish outer zone surrounding rings that are mostly blue with white inscriptions – again represent the spheres of the cosmos. Moving from inside out, the four inner circles of red, blue, green and yellow, respectively, represent the four elements (earth, water, air and fire). These enclose the mouth of hell at their core. The next rings represent the spheres of the seven planets (the moon, Mercury, Venus, the sun, Mars, Jupiter and Saturn). The outer three spheres represent the Crystalline Heaven (the *primum mobile* or “First Moved”) and the Empyrean. The outer edges are sometimes filled with or surrounded by angels; illuminators were able to try out various positions for these figures since de Metz’s description remained vague: “The world is in the shape of a ball. Heaven surrounds the world, the seven spheres of the planets, and the ether, a pure air from which the angels assume their shape.”⁶⁷

The burgeoning production of encyclopedias, thus, engendered a host of very different texts illuminated with a compound mode of representation to depict both the earth and the spheres together, as described above.⁶⁸ Combined modes of representation in the same picture are featured in other illuminated manuscripts of encyclopedic texts, such as the *Liber de proprietatibus rerum* by Bartholomew of England;⁶⁹ manuscripts with the French translation by Oresme of Aristotle’s *On the Heavens*, with Évrart de Conty’s *Les Echecs amoureux* (Ill. 24); with Brunetto Latini’s *Livres dou Tresor*;⁷⁰ and with Nicolas de Lyra’s influential commentary on Genesis, *Postillae*.⁷¹

But what connects these diverse compound modes of representing the cosmos? What enabled their use in illuminating such very different texts? The illustrated manuscript of Oresme’s translation of Aristotle’s *On the Heavens* pictures a distant, haloed God radiating outward from a kind of spherical crater.⁷² The beholder is positioned at the base of the illustration, on the layer of green grass that covers the earth. Only a small section of the spheres, which extend down from heaven towards the earth without touching it, is visible from our perspective. In a manuscript featuring Évrart de Conty’s *Livre des échecs amoureux moralisés* (died 1405), an encyclopedic commentary on his *Eschés amoureux* (based on the *Roman de la Rose* by Guillaume de Loris and Jean de Meun), one also

Ill. 21 Historienbibel, Cod. 2771, depiction of the cosmos with signs of the zodiac (fol. 9r), Evert Van Zoudenbalch, c. 1460. Manuscript illumination. Vienna, Österreichische Nationalbibliothek, Inv. E 23841 C.



encounters a representation of the cosmos as seen from the earth's surface gazing outward into the surrounding spheres (see Ill. 24). Here, the depiction combines a distant view of the earth's surface and a vertical section of the spheres,⁷³ enabling the beholder to gain new insights into the cosmos. By placing the viewer in a position that is impossible to achieve in reality, the artist not only provides new insights into the cosmos and the impact of seeing the world in moving spheres, but also knowledge about the invisible parts of the cosmos.⁷⁴

What, then, can be gathered from the two developments described so far? First, that painters along the Rhine

in about 1460 were informed about the scientific knowledge of their age, but that they also drew innovative details from their everyday lives. This source of knowledge was enriched by the artists' individual observation of the heavens and of the scattering, diffraction and refraction of light.⁷⁵ Second, we can discern the ways in which these artists combined different modes of representation as well as how they represented the earth surrounded with spheres as a sort of spinning wheel, a cosmos set in motion. In doing so, these artistic experiments in illumination work were able to represent both the earth *and* what lies beyond the horizon of the visible world. These painters



III. 22 Weltchronik, Netherlandish Historienbibel, Cod. 325, God with heavenly hosts above the celestial spheres (fol. 2v), c. 1500. Manuscript illumination. Vienna, Österreichische Nationalbibliothek, Inv. E23971 C.

invite the beholders of their innovative creations to think in spheres, to change their position in relation to the world, to move and travel virtually and spatially while also travelling on its surface mentally.

Knowing about the spheres' movements enables the beholder to travel mentally beyond a static visible sphere. A fifteenth century manuscript depicts a group of scholars looking at the globe from afar from a firmly earthbound position (Ill. 25). This illumination refers to the tradition of the divine creator looking upon his creation; it is even embedded in an image representing one of the acts of divine creation, thereby providing a kind of God-like

vision of the cosmos. Day and night are evident since colour perspective (with the colour graduated in keeping with a standard painterly technique for creating depth) acts in conjunction with the different tones of daylight. The earth upon which the men gaze is inhabited, and several cities are embedded in landscapes featuring brown hills while green vegetation is visible from a distance. Back on *their* earth, the astronomers stand amid grassy, treeless hillocks dotted with small, broad-leaved plants rendered in a darker shade of green. Only the divine creator would actually be able to observe the earth from such a perspective, as a manuscript made in roughly the same

period and context reveals (Ill. 26). Here the celestial spheres surround God enthroned in Heaven. His aura is shaped like the pupil of a huge celestial eye whose iris is formed by the spheres. The heavens below retain a suggestion of the circuits of the planets, while Adam and Eve stand happily unclothed in paradise, bearing similarities to Jan van Eyck's famous depiction of the first humans on the Ghent altarpiece. At Ghent, however, they appear in separate niches, in a kind of dark interior, detached from the landscape of the paradise depicted at the altar's core, which is seen from a slightly elevated position as in the Feldbach altar (see Ill. 1).

So-called "colour perspective" (*Farbperspektive*) refers to the art historical conventions of creating pictorial depth by tinting the landscape with a relatively systematic sequence of colours. According to Janis Bell the dominant model was the

three-zone colour perspective (...) in Italian and Northern painting in the sixteenth century (...) where the landscape is composed of a foreground of greens and browns, ending in a middle zone with dark green, then a zone of bluish green, and finally a blue mixed with white.⁷⁶



Ill. 23 L'image du Monde, MS fr 14964, the earth in the centre of the celestial spheres (fol. 117r), Gossuin de Metz, c. 13th century. Manuscript illumination. Paris, Bibliothèque nationale de France.



Ill. 24 *Le livre des échecs amoureux moralisés*, MS fr 143, cosmographic schema (fol. 20r), Evrart de Conty, c. end of 15th century. Manuscript illumination. Paris, Bibliothèque nationale de France.

It first appeared in the fifteenth century in Flanders and in Italy. The colours are arranged in keeping with the correct order, observed by natural philosophers explaining the double rainbow with its inversed colour sequence. Their sequence, determined by the distance of the depicted space from the viewer or to the horizon, replicates their sequence in the rainbow – pastel blue in the far distance; light green and yellow pastel tones in the middle ground, and red and other vivid colours in the foreground (see Ill. 4, Ill. 7, Ill. 8, and Ill. 27). This technique, which was particularly popular with fifteenth-century Flemish painters, most likely originated in direct observation of atmospheric changes and tracking how the colours of the landscape appeared at different times of day.

It comes as no surprise that early depictions of the earth's curvature – similar to the Feldbach altar – are also found in illuminations made for the wealthy and educated. Évrard d'Espinques, a French illuminator born in Cologne, depicts the curvature in an illumination for a manuscript featuring the French translation of Bartholomew of England's encyclopedia, the *Livre des propriétés des choses* (BnF 9140, fol. 35, see Ill. 27). D'Espinques depicts two sailing boats and the pole star, which was used for maritime navigation. Although the sails of the boats are not unfurled, a regular pattern of waves indicates wind. Swifts soar in the clear, blue sky in the upper half of the picture. The lightest blue appears at the curved horizon, the fine line where sea and heaven meet. Two groups

of towers, placed in the foreground at the left and right edges of the image, are embedded in a relatively flat landscape. Although the actual shoreline is invisible, the three ensembles of trees silhouetted against the water diminish any sense of a steep cliff lurking at the hidden edge of the landmass and the water. The situation here seems unrelated to personal observation of actual natural phenomena, unlike the detailed, transparent depiction of a rainbow, with its correctly sequenced and very specific colour changes, or the depiction of the sky changing from night to dawn and its reflection on water that appear in the same manuscript.⁷⁷ In another manuscript, Évrard d'Espinques (or one of his collaborators) chose to feature the background motif of the earth's curvature again. However, in the site chosen here, perception of the phenomenon would be unlikely, if not impossible: a terrestrial, rather than watery, landscape serves as a background for Christ's



Ill. 25 *Le Livre des propriétés des choses de Bartholomeus Anglicus*, MS fr 134, astronomers (fol. 169), Jehan Corbechon, ca. 1480. Manuscript illumination. Paris, Bibliothèque nationale de France.



III. 26 Le livre des sept âges du monde, MS 9047, Adam and Eve in Paradise with a christian-geocentric worldview (fol. 1v), Marmion Simon/Jacquemart Pilavaine, 1460. Manuscript illumination. Brussels, Koninklijke Bibliotheek.



Ill. 27 Le Livre des propriétés des choses de Bartholomeus Anglicus, MS fr 9140, Polaris and ships offshore (fol. 35r), Jehan Corbechon, c. 1480. Manuscript illumination. Paris, Bibliothèque nationale de France.

descent to Limbo.⁷⁸ The beholder sees the curved edge of the world while glimpsing, at the same time, the temporal end of the world since the illuminator locates the beholder at the entrance to Limbo, ready to follow Christ down beneath the bent surface of the earth. In all of these manuscripts, the depiction of invisible phenomena like the earth's curvature and the spheres is embedded in scholarly reflections about the visible world and what lies beyond. The painter of the Feldbach altar, however, goes a step further: He embeds this knowledge (and his reflections on it) in the scenes of the passion and also in a mental experiment: the beholder's gaze is guided in each scene on the wings toward different cardinal points, while observing the celestial signs in the course of an entire day from dusk to dawn.

The middle of the fifteenth century, conversely, witnessed the artistic integration of diverse systems of natural knowledge. Artists extended the knowledge they had acquired from scholarly texts with their own individual observations. The works examined here – the Feldbach altarpiece (see Ill. 1, Ill. 2, and Ill. 3), the illuminations for Bartholomew of England's encyclopedic texts (see Ill. 10, Ill. 25, and Ill. 27) and the miniature in the *Historienbibel* (see Ill. 21), among others – exhibit an intimate knowledge of optics acquired through both study and experience. Because it was transmitted in the abstract form of a diagram, which inspires speculation, imagination and extension, this knowledge about the moving spheres surrounding the world stimulated the conception of the earth's surface as the outer boundary of a sphere.

Returning again to the Feldbach altarpiece (see Ill. 1, Ill. 2, and Ill. 3), it is evident that its artist was not merely interested in a display of artistic versatility, or in presenting advances in optics in the form of a painted experiment. Rather, the work addresses a much broader question about the spherical form of the earth, the horizon as the membrane of the heavenly spheres and the Near East as both politically dangerous and a source of knowledge. Moreover, the work localizes Hell, Purgatory and the trajectory taken by Christ upon his ascension into Heaven within this spherical context. The Feldbach altarpiece seems, moreover, to manifest an extreme interest in the correct understanding of visible signs, such as the moon's halo or the order of the colours visible during dusk and dawn. By reading such signs the beholder can understand the different orientation of the panels of the Feldbach altar's wings and reflect upon the earth's orientation and curvature. With such pictorial clues the painter invites the beholder to move between perspectives and to think in spheres.

Conclusion

The relationship between treatises and images not only raises questions of religion and knowledge, but also of representation, specifically, how artistic representation can configure unknown, uncertain or unseen phenomena. The larger argument of this article examines two different, hitherto neglected traditions of representation, which are entangled and contributed to the so-called emergence of naturalism in the late Middle Ages.⁷⁹ The first consists of artists' attempts to find the "correct" place for the beholder, and the related issue of simultaneously representing both a view upon the earth *and* a view outside of it, toward the spheres surrounding the world. As we have seen, artists experimented with the position of the horizon in relation to the position of the beholder; the various conceptual and perceptual problems associated with this dynamic are manifest in the ways in which artists represented the earth's curvature and its relationship to the picture plane. Such artistic reflections in pictures were stimulated by the second tradition of representation regarding the distribution and reception of new optical and geometrical knowledge. This was made possible through newly accessible ancient and Arabic theories about the disposition of the cosmos and its optical perception.⁸⁰ These two traditions conjoined in the fifteenth century, in combination with increasing interest in observing and representing actual phenomena related to the sky at specific times of the day, including the horizon's curvature, colour perspective, reflection and refraction. Two extreme outcomes of this process may be observed: in some areas, as in Flemish painting, these processes further developed into the *Weltlandschaft*, the world landscape; in other locations, compositions developed that applied a constructed per-

spective, a practice Alberti described with the metaphor of the window opening onto a fictive space beyond the frame.

After the mid-fifteenth century, panel painters and illuminators of encyclopedic manuscripts began exploring means of depicting the round world within the frame of their largely square pictorial formats. They began articulating depth by tilting the picture plane, as it were, with the ground rising from the foreground upwards toward a high horizon in the background. Tilted planes of this kind, often with an array of graduated colours based on the spectrum, from yellow and red in the front to green and blue in the back, were a common feature in paintings of the time and eventually culminated in the genre of so-called world landscapes.⁸¹ Illuminators of manuscripts were even more eager to experiment with new ways to represent the layers of nested spheres surrounding the terrestrial realm. Their bending of the pictorial plane was accompanied, last but not least, by attempts to experiment with new modes of representation.⁸² In locating and exploring these strategies and interests, this article refers to Meyer Schapiro, who defined or "situated" the "field" as part of a structuralist operation that defines how an image operates not through mimetic form, but rather through non-mimetic qualities: shape, scale, orientation. In the case of the Feldbach altar, it becomes evident how these structural qualities of scale and orientation operate independently of what appears mimetically on the surface, though they define how they appear for the beholder. As such, they form an overlooked and often unseen force that may be understood as the field of operations in which pictorial language operates, as well as a factor that determines the spectator's interaction with an image.⁸³ This article functions as a micro-history of a specific painting and its maker's knowledge. It also presents a macro-history of the relationship between knowledge and artistic practice, particularly at a moment when artists began to turn their attention to depicting – paradoxically – the unseen.

AUTHOR

Beate Fricke, Prof. Dr., Art Historian, Institute of Art History, University of Bern, Mittelstr. 43, CH-3012 Bern, beate.fricke@ikg.unibe.ch

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- ¹ MARCUS DEKIERT, *Oberrheinischer Meister, Feldbacher Altar*, in: Spätmittelalter am Oberrhein: Maler und Werkstätten 1450–1525 (exh. cat., Staatliche Kunsthalle Karlsruhe), Stuttgart, 2001, pp. 107–109. – For an overview of the scholarship on this altar, see BODO BRINKMANN, *Der Feldbacher Altar*, in: Konrad Witz (exh. cat., Kunstmuseum Basel), Ostfildern, 2011, p. 305. – UTA FELDGES-HENNING, *Werkstatt und Nachfolge des Konrad Witz. Ein Beitrag zur Geschichte der Basler Malerei des 15. Jahrhunderts*, Basel, 1968, and JANA LUCAS, *Europa in Basel. Das Konzil von Basel (1431–1449) als Laboratorium der Kunst*, Basel, 2017, pp. 268–271. For the history of the representation of the curvature, see PETER KRÜGER, *Auf den Standort kommt es an. Zur Rolle des Horizonts in der Perspektive der Neuzeit*, in: Künste und Natur in Diskursen der Frühen Neuzeit, ed. HARMUT LAUFHÜTTE, Wiesbaden, 2000, pp. 475–495. – DAVID SUMMERS, *Horizons, or Infinities without End*, in: Wolkenkuckucksheim 12, 2007, <http://www.cloud-cuckoo.net/openarchive/wolke/eng/Subjects/071/Summers/summers.htm>, accessed 3 May 2022. HANNAH BAADER, *Horizont und Welle*, in: Linea I. Grafie di immagini tra Quattrocento e Cinquecento, eds MARZIA FAIETTI/GERHARD WOLF, Venezia, 2008, pp. 211–226. – GOTTFRIED BOEHM, *Wie Bilder Sinn erzeugen*, Berlin, 2007, pp. 72–93.
- ² The monastery of St. Katharinenthal was dissolved in 1869, later than Feldbach, which is why I state Frauenfeld as the original location, although I agree that an original location at St. Katharinenthal resonates well with the choice of saints.
- ³ JANA LUCAS (cf. n. 1), p. 268.
- ⁴ Jan van Eyck’s crucifixions do not show the ocean, but aim for the deepest distance, e.g. in the crucifixion at Berlin or in the New York diptych with the crucifixion and the Last Judgment or the crucifixion at the Ca d’Oro by one of his followers. A clear predecessor is the crucifixion in the Turin-Milan Book of Hours, MS 46, fol. 48v. For Italian crucifixions with the seashore as backdrop, see Antonella da Messina’s crucifixions in Antwerp and Bukarest, and Vivarini, crucifixion, Museo Civico, Pesaro; for a colour reproductions, see TILL-HOLGER BORCHERT, *Jan van Eyck und seine Zeit. Flämische Meister und der Süden (1430–1530)*, Stuttgart, 2002, pp. 84, 104 and 124.
- ⁵ LORENZ DITTMANN, *Farbgestaltung in der europäischen Malerei. Ein Handbuch*, Cologne, 2010.
- ⁶ BODO BRINKMANN (cf. n. 1), pp. 302–305.
- ⁷ ALFONS RAIMANN and PETER ERNI, *Die Kunstdenkmäler des Kantons Thurgau*, 6: Der Bezirk Steckborn, Bern, 2001, pp. 383–402.
- ⁸ BERND KONRAD, *Die spätgotischen Tafeln im Historischen Museum des Kantons Thurgau in Frauenfeld. Untersuchungen zur Unterzeichnung mittels Infrarotreflektografie – zugleich ein Katalog*, in: Mitteilungen aus dem Thurgauischen Museum 30, 1994, pp. 9–57, here pp. 18–29.
- ⁹ MARCUS DEKIERT (cf. n. 1), pp. 107–109. – BODO BRINKMANN (cf. n. 1), p. 305, providing an overview of the scholarship on this altar. – UTA FELDGES-HENNING (cf. n. 1). – See also MADELEINE WITZIG-HAGER, *Der Feldbacher Altar, ein Spiegel der niederländischen “ars nova” am Bodensee*, in: Kunst + Architektur in der Schweiz 57/1, 2006, pp. 65–66. – Cf. also MAIKE CHRISTADLER, *Alleinstellungsmerkmale des wahrhaft großen Künstlers. Konrad Witz; die einzigartige Ausstellung*, in: Kunstchronik 64/6, 2011, pp. 311–316. – Daniel Hess has since critically examined this suggested closeness. See DANIEL HESS, *Die oberrheinische Malerei vom Paradiesgärtlein bis zum jungen Dürer. Ein Überblick über die jüngere Forschung*, in: Kunstchronik 55/8, 2002, pp. 373–385.
- ¹⁰ Two recent studies offer new insights into this issue as it pertains to the regions of the Rhine and Rhône: Florens Deuchler’s investigations of Konrad Witz’s stays in Italy and the connections established by Marcus Mraas among the *Bylant Book of Hours*, illuminated at Cologne, the young Dürer and the aged Schongauer at the Upper Rhine. – And MARCUS MRAAS, *Kupferstiche als Vorbilder. Ein professionelles Repertoire und der fromme Gebrauch von Spielkarten*, in: Das Stundenbuch der Sophia von Bylant, eds RAINER BUDDE/ROLAND KRISCHEL, Cologne, 2001, pp. 187–205.
- ¹¹ TANJA MICHALSKY, *Projektion und Imagination. Die niederländische Landschaft der Frühen Neuzeit im Diskurs von Geographie und Malerei*, Paderborn, 2011. – DETLEF ZINKE, *Patinirs “Weltlandschaft”. Studien und Materialien zur Landschaftsmalerei im 16. Jahrhundert*, Frankfurt am Main, 1977. – CHRISTOPH ASENDORF, *Von der “Weltlandschaft” zur planetarischen Perspektive. Der Blick von oben in der Sukzession neuzeitlicher Raumvorstellungen*, in: Kritische Berichte 37/3, 2009, pp. 9–22.
- ¹² *Forschungen und Fortschritte: Korrespondenzblatt der deutschen Wissenschaft und Technik* 41, 1967, p. 305.
- ¹³ MARC DE MEY et al. (eds), *Vision and Material. Interaction between Art and Science in Jan van Eyck’s Time*, Brussels, 2012, p. 40.
- ¹⁴ JEAN JOLIVET, *The Arabic Inheritance*, in: A History of Twelfth-Century Western Philosophy, ed. PETER DRONKE, Cambridge, 1988, pp. 113–48. – GUNDULA GREBNER/JOHANNES FRIED (eds), *Kulturtransfer und Hofgesellschaft im Mittelalter. Wissenskultur am sizilianischen und kastilischen Hof im 13. Jahrhundert*, Berlin, 2008. – ANDREAS SPEER/LYDIA WEGENER (eds), *Wissen über Grenzen. Arabisches Wissen und lateinisches Mittelalter*, Berlin, 2006. – MICHELE GOYENS et al. (ed.), *Science Translated. Latin and Vernacular Translations of Scientific Treatises in Medieval Europe*, Leuven, 2008.
- ¹⁵ EMMANUEL ALLOA, *L’oubli du médium. Optique et métaphysique de la lumière*, in: La lumière parle, eds FRÉDÉRIC COUSINIE et al., Paris, 2016, pp. 31–53. – For Jan van Eyck, see MARC DE MEY (cf. n. 13), pp. 45–50. – For the medieval concepts of *scientia* and *experientia*, see HEDWIG RÖCKELEIN, *Einleitung. Experten zwischen scientia und experientia*, in: Das Mittelalter 17/2, 2012, pp. 3–15. – JOHANNES JAHN, *Ein Kompositionsprinzip der Natur- und Innenraumdarstellung der Renaissance*, in: Acta Historiae Artium der Ungarischen Akademie der Wissenschaften 13, 1967, pp. 17–24, here p. 20. – RUDOLPH PREIMESBERGER, *Zu Jan van Eycks Diptychon der Sammlung Thyssen-Bornemisza*, in: Zeitschrift für Kunstgeschichte 54/4, 1991, pp. 459–489, here pp. 470–73. – STEPHAN KEMPERDICK/FRISO LAMMERTSE (eds), *The Road to Van Eyck*, Rotterdam, 2012. – DAVID SUMMERS, *Vision, Reflection and Desire in Western Painting*, Chapel Hill, 2007, p. 132. – For artists engaged in the ‘sciences’, see PAMELA SMITH, *Art, Science and Visual Culture in Early Modern Europe*, in: Isis. A Journal of the History of Science Society 97/1, 2006, pp. 83–100. – PAMELA SMITH, ‘Art’ Is to ‘Science’ As ‘Renaissance’ Is to ‘Scientific Revolution’? *The Problematic Algorithm of Writ-*

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- ¹⁶ AMELIA CAROLINA SPARAVIGNA, *On the Rainbow, a Robert Grosseteste's Treatise on Optics*, in: International Journal of Sciences 2/9, 2013, pp. 108–113.
- ¹⁷ For an overview of the extant scholarship, see BODO BRINKMANN (cf. n. 1).
- ¹⁸ ROBERT GROSSETESTE, *De Iride*, cap. 15: “Cum autem color sit lumen admixtum cum diaphano, diaphanum vero diversificetur, secundum puritatem et impuritatem, lumen autem quadrifarie dividatur, secundum claritatem scilicet et obscuritatem et tunc secundum multitudinem et paucitatem, et secundum harum sex differentiarum connumeraciones sint omnium colorum generationes et diversitates, varietas coloris in diversis partibus unius et eiusdem iridis maxime accidit propter multitudinem et paucitatem radiorum solis. Ubi enim est maior radiorum multiplicatio, apparet color magis clarus et luminosus; ubi vero minor est radiorum multiplicatio, apparet color magis attinens hyacinthino et obscuro. Et quia luminum multiplicatio et a multiplicatione ordinata diminutio non sit, nisi per resplendentiam luminosi super speculum, vel a diaphano, quod per figuram suam in loco quodam congregat lumen et in loco conveniente disgregando dimittit, et haec dispositio receptionis luminis non est dispositio fixa, manifestum est, quod non est in potestate pictorum assimilare iridem, cum tamen sit possibilis eius assimilatio secundum dispositionem non fixam.” — “However, the colour is light mixed with a transparent medium; the medium is diversified according to the purity and impurity, but the light is fourfold divided; it is to be divided according to the brightness and, of course, to the obscurity, and according to intensity (richness) and tenuity (thinness), and according to the six different enumerations the variety of all the colours is generated, the variety of colours that appear in the different parts of a single rainbow, is mainly due to the intensity or tenuity of the rays of the sun. Where there is a greater intensity of light, it appears that the colours are more luminous and bright: but where there is less intensity of light, it appears that the colour turns to the dark colour of hyacinthus. And because the intensity of light and the decrease of intensity is not subjected to a rule, except in the case of light shining on a mirror, or passing through a transparent medium, which, by means of its own shape, can gather the light in a certain place, and, in a certain place can disrupt the light, diminishing it, and the arrangement of receiving the light is not a fixed one, it is clear that that it is not in the skill of an artist to reproduce the rainbow, but it is possible to imitate accordingly to a certain arrangement.” Trans. AMELIA CAROLINA SPARAVIGNA (cf. n. 16), pp. 108–113.
- ¹⁹ Paris, BnF, MS Fr. 22533, fol. 192v, made between 1450–1474 and Paris, BnF, MS Fr. 134, fol. 208v as well as the depiction of finding precious stones on fol. 262v.
- ²⁰ See for example the diagram in the manuscript preserved at the Universitätsbibliothek Leipzig, MS 512, fol. 69r, Dietrich of Freiberg, *De Iride*, illustration of the principles of reflection and refraction in a rainbow. Dietrich of Freiberg's rainbow theory, written between 1304 and 1311 (*De iride, de coloribus*), could also be considered a theory of colour or a reflection on the perception of light. He is presumably the first to describe not only the rainbow, but also the second rainbow (whether and why there is one), and to distinguish five different ways in which light breaks. What seems significant to me is that Dietrich must obviously have used diagrams to demonstrate his thoughts, but although many of the manuscripts containing *De iride* are accompanied by drawings, none of them is actually fully correct.
- ²¹ This is the origin of the later Flemish practice of the so-called world landscape. DETLEF ZINKE (cf. n. 11).— CHRISTOPH ASENDORF (cf. n. 11).
- ²² For recent studies emphasizing the importance of wings and multiple modes of seeing, including establishing the different views of the winged altar in relation to liturgical objects, see DAVID GANZ and MARIUS RIMMELE, *Klappeneffekte. Faltbare Bildträger in der Vormoderne*, Berlin, 2016.— Roland KRISCHEL, *Bilder, die klappen: zur Kinetik religiöser Gemälde im spätmittelalterlichen Köln*, Wallraf-Richartz-Jahrbuch 75 (2014), pp. 51–130.
- ²³ On the outer left wing St. Michael and St. Dionysius are depicted above and below Mary Magdalene and Mary with the child, while the right outer wing depicts St. Stephen and St. Barbara with St. Dorothea and St. Agnes below. Regarding the use of gilded brocade ground, see GABRIEL DETTE, *Der Basler Heilspiegelaltar*, in: KUNSTMUSEUM BASEL (cf. n. 1), pp. 88–99 and BODO BRINKMANN (cf. n. 1), p. 304.
- ²⁴ This staged display of standing and kneeling saints, originally against a gilded brocade ground, recalls Konrad Witz's Heilspiegelaltar at Basel.
- ²⁵ The ship appears to be a two-masted carrack, where the main mast is square-rigged; the unfurled sail on the mizzenmast ought to be lateen-rigged. The details in this altarpiece, especially of the single-masted ships are, however, too vague to further define the types of ships. See JONATHAN ADAMS, *A Maritime Archaeology of Ships. Innovation and Social Change in Medieval and Early Modern Europe*, Oxford, 2013. I would like to thank anonymous reviewer of this paper for suggestions and observations regarding the ship types.
- ²⁶ LYNN THORNDIKE, *The Sphere of Sacrobosco and Its Commentators*, Chicago 1949.— KATHRIN MÜLLER, *Visuelle Weltaneignung. Astronomische und kosmologische Diagramme in Handschriften des Mittelalters*, Göttingen, 2008.— MICHAEL CROWE, *Theories of the World from Antiquity to the Copernican Revolution*, Mineola, NY, 2000.— KLAUS ARNOLD, *Konrad von Megenberg als Kommentator der "Sphaera" des Johannes von Sacrobosco*, in: Deutsches Archiv für Erforschung des Mittelalters namens Monumenta Germaniae Historica 32, 1976, pp. 146–186. For artists engaged in the 'sciences', see PAMELA SMITH, 2006 (cf. n. 15), pp. 83–100.— PAMELA SMITH, 2008 (cf. n. 15), pp. 427–45.— ANDREAS SPEER/INGRID CRAEMER-RUEGENBERG (cf. n. 15).— DAVID SUMMERS, 1994 (cf. n. 15).— DAVID SUMMERS, 2007 (cf. n. 15).
- ²⁷ Several dozens diagrams already illustrate this idea in the thirteenth and fourteenth century manuscripts containing Sacrobosco's text. See the detailed study of these diagrams by KATHRIN MÜLLER (cf. n. 26).— For the use of armillary spheres in teaching, see BEATE FRICKE, *Ockhams Rasiernesser und Oresmes Armillarsphäre*, in: Komplexität und Einfachheit, ed. ALBRECHT KOSCHORKE, Stuttgart, 2017, pp. 541–570.
- ²⁸ LYNN THORNDIKE (cf. n. 26), p. 121.— Sacrobosco, *De Sphaera*: “That the water has a bulge and is approximately round is shown thus: Let a signal be set up on the seacoast and a ship leave port and sail away so far that the eye of a person standing at the foot of the mast can no longer discern the signal. Yet if the ship is topped, the eye of the same person if he has climbed to the top of the mast, will see the signal clearly. Yet the eye of a person at the bottom of the mast ought to see the signal better than he who is at the top, as is shown by drawing straight lines from both to the signal. And there is no other explanation of this thing than the bulge of the water. For all other impediments are excluded, such as clouds and rising vapors.” Diagrams illustrating refraction accompany only the manuscripts preserved at Oxford, Bodleian Library, Canon. Misc. 161 and in Princeton, from the library of Robert Garrett, MS 99.

- ²⁹ KATHRIN MÜLLER (cf. n. 26), p. 25.— For a Latin text and an English translation, see LYNN THORNDIKE (cf. n. 26), pp. 76–117 (Latin), and pp. 118–142 (English translation).— The first commentaries were written in the first half of the thirteenth century, see LYNN THORNDIKE (cf. n. 26), pp. 21–42.— For the use at the universities of Paris and Oxford, see CLAUDE LAFLEUR/JOANNE CARRIER, *L'enseignement de la philosophie au XIIIe siècle. Autour du Guide de l'étudiant du MS. Ripoll 109* (=Actes du Colloque international), Turnhout, 1997.
- ³⁰ Cleomedes, *The Heavens*, see ALAN C. BROWN/ROBERT B. TODD, *Cleomedes' lectures on astronomy. A Translation of "The Heavens"*, Berkeley, 2004, pp. 71–72: "Also, when at sea we are about to approach land, our line of sight first encounters mountain peaks, while everything else is obstructed by the earth's curvature. Next as we go over the curvatures, we encounter in the course of the journey the sides and spurs of mountains. And within the boats themselves, when we ascend the mast and get above the obstructing curvatures, we invariably see those parts of the land that are visible from the decks and the hold. Also, when a ship leaves land, the hulls disappear first, although the masts are still visible; but when it approaches land from the sea, then by the same token, the masts are seen first, while the hulls are still obstructed by the curvature of the water. All these [phenomena] indicate through virtually geometrical demonstrations that the shape of the earth is spherical." The earliest Greek manuscripts belong to the period around 1300. The first Latin translations appeared during the fifteenth century, the century when more than forty copies were made of the text. However, *The Sphaera* of John of Sacrobosco (completed in 1244) also retained a canonical status and was regularly the subject of commentaries.
- ³¹ I am grateful to Frank Bezner, who brought this observation to my attention. See Calcidius, *Platonis Timaeus et Commentarius*, XLII, 109.
- ³² ARISTOTLE, *De caelo*, book 2, chapters 13 and 14. It remains unclear through which medieval authors Thales, who also described the earth as round, was transmitted.
- ³³ REINHARD KRÜGER, *Das lateinische Mittelalter und die Tradition des antiken Erdkugelmodells. Ca. 550–ca. 1080*, Berlin, 2000.— JÜRGEN HAMEL, *Die Vorstellung von der Kugelgestalt der Erde im europäischen Mittelalter bis zum Ende des 13. Jahrhunderts*, Münster, 1996.— ANNA-DOROTHEE VON DEN BRINCKEN, *Die Kugelgestalt der Erde in der Kartographie des Mittelalters*, in: *Archiv für Kulturgeschichte* 58, 1976, pp. 77–95.— JÜRGEN WOLF, *Die Moderne erfindet sich ihr Mittelalter – oder wie aus der "mittelalterlichen Erdkugel" eine "neuzzeitliche Erdscheibe" wurde*, Stuttgart, 2004.
- ³⁴ PLINY, *Naturalis historia*, 2, LXV, pp. 163–164 (298). Strabo proves that the earth is round as follows: "... for our sense-perception and also our intuition can bear testimony in the latter case. For instance, it is obviously the curvature of the sea that prevents sailors from seeing distant lights at an elevation equal to that of the eye; however, if they are at a higher elevation than that of the eye, they become visible, even though they be at a greater distance from the eyes; and similarly if the eyes themselves are elevated, they see what was before invisible. This fact is noted by Homer, also, for such is the meaning of the words: 'With a quick glance ahead, being upborne on a great wave, [he saw the land very near].' So, also, when sailors are approaching land, the different parts of the shore become revealed progressively, more and more, and what at first appeared to be low-lying land grows gradually higher and higher." Strabo, *Geographica*, vol. 1, pp. 42–43.
- ³⁵ For an overview of Sacrobosco and his reception, see EDWARD GRANT, *Planets, Stars and Orbs. The Medieval Cosmos, 1200–1678*, Cambridge, 1994, pp. 118–119 and pp. 654–655.— For manuscripts with illustrations containing his writings, see KATHRIN MÜLLER (cf. n. 26).
- ³⁶ Robert Grosseteste (d. 1253) presumably wrote *De sphaera* at Oxford.
- ³⁷ Oxford, Bodleian Library, Can. Misc. 161.
- ³⁸ LYNN THORNDIKE (cf. n. 26), p. 83. The blind eye could be thought together with the figure of seeing with the heart. See HANS AURENHAMMER, *Reflexionen des Sehens in Gemälden Giovanni Bellinis*, in: *Mobile Eyes. Peripatetisches Sehen in den Bildkulturen der Vormoderne*, eds DAVID GANZ/STEFAN NEUNER, Munich, 2013, pp. 199–240.
- ³⁹ FRANCIS B. BRÉVART, *Zur Überlieferungsgeschichte der "Deutschen Sphaera" Konrads von Megenberg*, in: *Beiträge zur Geschichte der deutschen Sprache und Literatur* 102, 1980, pp. 189–214. For an early modern German version, see KONRAD HEINFÖGEL, *Sphaera materialis*, 1516.
- ⁴⁰ *Das Buch der Natur* (The Book of Nature) is a compendium of scholarly knowledge that was edited and translated into German in the 14th century by Konrad von Megenberg (1309–1374). The book is based on the *Liber de natura rerum* by the 13th-century Dominican priest Thomas of Cantimpré. However, Konrad made several revisions to the original work, omitting material and including his own observations and corrections. The book was widely seminated until the 16th century and has survived in numerous manuscripts. It was first printed in Augsburg in 1475.
- ⁴¹ I owe this reference to Rebecca Müller, who has read and commented on this article. See her forthcoming article and GIACOMO MARANESI, *Il politico con le storie dei Santi Pietro e Paolo. Nuove ricerche sull'opera proveniente dalla chiesa di San Pietro in Penna a Fermo*, in: *Quaderni dell'Archivio Storico Arcivescovile di Fermo* 28, 2013, pp. 45–76.— See also GIACOMO MARANESI, *La chiesa di San Pietro a Fermo e il politico disperso*, Fermo 2013.— TIZIANA FRANCO, *Jacobello del Fiore a Fermo. Sui quadriccioli rappresentanti le gesta dei santi apostoli Pietro e Paolo*, in: *Medioevo. Immagine e racconto*, ed. ARTURO CARLO QUINTAVALLE, Milan, 2003, pp. 485–495.— ANDREA DE MARCHI/TIZIANA FRANCO, *Il gotico internazionale. Da Nicolò di Pietro a Michele Giambono*, in: *Pittura veneta nelle Marche*, ed. VALTER CURZI, Cinisello Balsamo, 2000, pp. 53–85.— FEDERICO ZERI, *Jacobello del Fiore. La pala di San Pietro a Fermo*, in: *Diari di lavoro* 1, Bergamo, 1971, pp. 38–45.
- ⁴² LAURINDA DIXON, *Giovanni di Paolo's Cosmology*, in: *The Art Bulletin* 67, 1985, pp. 604–613.
- ⁴³ HANS BLUMENBERG, *Der Prozeß der theoretischen Neugierde*, Frankfurt am Main, 1973, p. 292 and DIETER GROH/RUTH GROH, *Von den schrecklichen zu den erhabenen Bergen. Zur Entstehung ästhetischer Naturerfahrung*, in: *Weltbild und Naturaneignung. Zur Kulturgeschichte der Natur*, Frankfurt am Main, 1991, vol. 1, pp. 92–149, here pp. 109–122.— HANS ROBERT JAUSS, *Ästhetische Erfahrung und literarische Hermeneutik. Versuche im Feld der ästhetischen Erfahrung*, vol. 1, Munich, 1977, p. 112.
- ⁴⁴ Honorius Augustudonensis, *De cognitione verae vitae*, cap. XLII, PL 40, col. 1027: "Unde liquet quod nullius hominis visus totum hujus aeris spatium penetret, qui vix etiam horizontem attingere valet. Unde cum Apostoli Dominum sublatum ulterius videre non possent, dicitur: Nubes suscepit eum ab oculis eorum." See also PHILIP L. REYNOLDS, *The Essence, Power and Presence of God. Fragments of the History of an Idea, from Neopythagoreanism to Peter Abelard*, in: *From Athens to Chartres. Neoplatonism and Medieval Thought. Studies in Honour of Edouard Jeuneau*, ed. HAIJO JAN WESTRA, Leiden, 1992, pp. 350–380 and p. 366.
- ⁴⁵ ABSALON SPRINCKIRSBACKENSIS (d. 1150), *Sermones*, PL 211, col. 84C: "Christus ergo Deus et homo ipse est stella, in quam visus mentis nostrae dirigi debet, imo in quam velut horizonte quodam terminatur, siquidem in humanitate ejus opus nostrae salutis videmus. Habet ergo visus spiritalis horizontem suum, sicut et corporalis. Horizon visus corporalis est, circularis illa conferentia, ubi ex defectu visus coelum terrae quodammodo conjungi videtur. Et, horizon visus spiritalis est, ubi celsitudo divinitatis ad suscipiendam humanam naturam inclinatur, si dicas quomodo visus ibi deficit."
- ⁴⁶ PETER KRÜGER (cf. n. 1), p. 480.

- ⁴⁷ SVETLANA ALPERS, *Interpretation without Representation, or, The Viewing of Las Meninas*, in: *Representations* 1, 1983, pp. 30–42, here p. 37.
- ⁴⁸ SVETLANA ALPERS, *ibid.*, p. 38. See also SVETLANA ALPERS, *The Art of Describing. Dutch Art in the Seventeenth Century*, Chicago 1983. I am not arguing that the painter of the Feldbach altar has read Alberti. I presume that such artistic knowledge has travelled and was widespread among painters before it was written down by Alberti.
- ⁴⁹ Leon Battista Alberti, *De pictura* 1, § 20: “His ergo diligenter absolutis, unam item superduco transversam aequa ceteris inferioribus distantem lineam, quae duo stantia magni quadrati latera secet, perque punctum centricum permeet. Haec mihi quidem linea est terminus atque limes, quem nulla non plus alta quam sit visentis oculus quantitas excedat. Eaque quod punctum centricum pervadat, idcirco centrica dicatur.” LEON BATTISTA ALBERTI, *Das Standbild. Die Malkunst. Grundlagen der Malerei*, ed. OSKAR BÄTSCHMANN, trans. CHRISTOPH SCHÄUBLIN, Darmstadt, 2000, pp. 230–231. LEON BATTISTA ALBERTI, *Über die Malkunst. Della pittura*, ed. and trans. OSKAR BÄTSCHMANN/SANDRA GIANFREDA, Darmstadt, 2001, p. 97. The term “linea centrica” is also used to describe the diameter drawn through a circle (*De pictura*, 1, § 2). For the relationship between horizon and perspective, see CÉLINE FLÉCHEUX, *L’horizon. Des traités de perspective au land art*, Rennes, 2009, pp. 49–55 and DAVID SUMMERS (cf. n. 1).
- ⁵⁰ HUBERT DAMISCH, *The Origin of Perspective*, trans. JOHN GOODMAN, Cambridge, 1995, and HUBERT DAMISCH, *Theory of/Cloud/: Toward a History of Painting*, trans. JANET LLOYD, Stanford, 2002. I would like to thank anonymous reviewer for the suggestions especially regarding this aspect.
- ⁵¹ HANS AURENHAMMER, “Linea centrica” und gekrümmter Erdenrand. Horizonte in italienischen Bildern des 15. Jahrhunderts, in: *Shifting Horizons*, eds BEATE FRICKE/LUCAS BURKART, Basel (in press). The dominant narrative linking the rise of the single point perspective with Alberti’s tract and the overemphasis of the single point perspective’s importance as a foundation for modern science has come to be questioned in recent years. FLORIAN KLINGELE, *Fluchtpunkt und Theophanie. Zentralperspektive als Visualisierung des Göttlichen in der Malerei der italienischen Renaissance*, in: *Ars imitatur naturam. Transformationen eines Paradigmas menschlicher Kreativität im Übergang vom Mittelalter zur Neuzeit*, ed. ARNE MORITZ, Münster, 2010, pp. 145–166. Samuel Edgerton went so far as to argue that without single point perspective one would not be able to “visualize and then construct the complex machinery that moved [Western man] out of the Newtonian paradigm into the new era of Einsteinian outer space – and outer time”. See SAMUEL Y. EDGERTON, *The Renaissance Rediscovery of Linear Perspective*, New York, 1975, p. 165. For a substantial critique of Edgerton’s claim, see MARTIN KEMP, *Relativity not Relativism. Some Thoughts on the History of Science and Art, Having Reread Panofsky*, in: *Meaning in the Visual Arts. Views from the Outside. A Centennial Commemoration of Erwin Panofsky (1892–1968)*, ed. IRVIN LAVIN, Princeton, 1995, pp. 225–236, here p. 230. Most recently Hans Belting has described how the reception of optical theories through the translations and tracts of Arabic scholars has contributed significantly to changes in Western natural philosophy and the representational systems applying their insights. HANS BELTING, *Florence and Baghdad: Renaissance Art and Arab Science*, trans. DEBORAH LUCAS SCHNEIDER, Cambridge 2001. HEIKE SCHLIE, *The Invention of Innovation. “Zentralperspektive” und “Ars Nova” als Positionierungen des Neuen*, in: *Das Ursprüngliche und das Neue. Zur Dynamik ritueller Prozesse in Geschichte und Gegenwart*, eds BURCKHARDT DÜCKER/GERALD SCHWEDLER, Münster, 2008, pp. 227–256.
- ⁵² For a theory of diagrammatic representation see STEFFEN BOGEN/FELIX THÜRLEMAN, *Jenseits der Opposition von Text und Bild. Überlegungen zu einer Theorie des Diagramms und des Diagrammatischen*, in: *Die Bildwelt der Diagramme Joachims von Fiore. Zur Medialität religiös-politischer Programme im Mittelalter*, ed. ALEXANDER PATSCHOVSKY, Ostfildern 2003, pp. 1–22.
- ⁵³ For an extensive bibliography, see *Weltkarte des Andreas Walsperger*, facsimile ed. and commentary, Zurich, 1981. DOROTHEA HAUCK, *Die Weltkarte des Andreas Walsperger orientiert sich an mittelalterlicher klösterlicher Tradition*, in: *Bibliotheca Palatina (=exh. cat., Heiliggeistkirche Heidelberg)*, Heidelberg, 1986), pp. 358–359.
- ⁵⁴ PAUL GALLEZ, *Walsperger and His Knowledge of the Patagonian Giants*, 1448, in: *Imago Mundi* 33, 1981, pp. 91–93. WILLIAM A. R. RICHARDSON, *South America on Maps before Columbus? Martellus’ “Dragon’s Tail” Peninsula*, in: *Imago Mundi* 55/1, 2003, pp. 25–37. ANNA-DOROTHEE VON DEN BRINCKEN, *Fines Terrae. Die Enden der Welt und der vierte Kontinent auf mittelalterlichen Weltkarten*, Hannover, 1992, pp. 145–147.
- ⁵⁵ INGRID BAUMGÄRTNER, *Kartographie, Reisebericht und Humanismus. Die Erfahrung in der Weltkarte des venezianischen Kamaldulensermonchs Fra Mauro (d. 1459)*, in: *Das Mittelalter* 3, 1998, pp. 161–197, here pp. 175–176.
- ⁵⁶ TANJA MICHALSKY, *Projektion und Imagination*, Munich, 2011, p. 32.
- ⁵⁷ HARTMUT KUGLER (ed.) in collaboration with SONJA GLAUCH and ANTJE WILLING, *Die Ebstorfer Weltkarte. Kommentierte Neuausgabe in zwei Bänden*, Berlin, 2007.
- ⁵⁸ See, as already quoted above (cf. n. 18) the final paragraphs of Robert Grosseteste’s tract *De Iride* and with the same title, further developing his thoughts on the tract by DIETRICH OF FREIBERG, *De iride, de coloribus*.
- ⁵⁹ John 19, 42–47. Mark 15, 50–56. Luke 23, 57–60. Matthew 27, 57–61.
- ⁶⁰ Jacob Burckhardt wrote his most influential study, *Die Kultur der Renaissance in Italien*, after he started teaching in Basel in 1858 (published in 1860), ironically not far away from the Feldbach altarpiece. He describes the intentional and skilled use of colour perspective, and the importance of an encyclopedic education (including science) as an achievement of Alberti to characterize the Italian Renaissance. See JACOB BURCKHARDT, *The Civilization of the Renaissance in Italy*, London/New York, 1904, p. 137.
- ⁶¹ However, the inscription on the lid of the sarcophagus still seems to be pointing in exactly the same direction.
- ⁶² STEFAN WULF, *Arbeit und Nichtarbeit in norddeutschen Städten des 14. bis 16. Jahrhunderts. Studien zur Geschichte sozialer Zeitordnung*, Hamburg, 1991. GERHARD DOHRN-VAN ROSSUM, *Die Geschichte der Stunde. Uhren und moderne Zeitordnung*, München 1992. TRUDE EHLERT (ed.), *Zeitkonzeptionen, Zeiterfahrung, Zeitmessung. Stationen ihres Wandels vom Mittelalter bis zur Moderne*, Paderborn, 1997. RUDOLF WENDORFF, *Zeit und Kultur. Geschichte des Zeitbewußtseins in Europa*, Opladen, 1985. WERNER SULZGRUBER, *Zeiterfahrung und Zeitordnung vom frühen Mittelalter bis ins 16. Jahrhundert*, Hamburg, 1995. HERIBERT M. NOBIS, *Zeitmaß und Kosmos im Mittelalter*, in: *Mensura. Maß, Zahl, Zahlensymbolik im Mittelalter*, ed. ALBERT ZIMMERMANN, Berlin, 1984, pp. 261–76. ERHARD CHVOJKA, *Von der Sonne zur Uhr. Die “Protoindustrialisierung” des sozialen Zeitbewußtseins der mittel- und westeuropäischen Unterschichten vom Spätmittelalter bis zum Beginn der Industrialisierung*, Vienna, 1990. CYRIL F. C. BEESON, *Clockmaking in Oxfordshire 1400–1850*, Oxford, 1967.
- ⁶³ Regarding this chronicle, see SCOT MCKENDRICK, *The Master of Anthony of Burgundy, Master of the Dresden Prayer Book and Master of Margaret of York*, in: *Illuminating the Renaissance. The Triumph of Flemish Manuscript Painting*, eds THOMAS KREN/SCOT MCKENDRICK, Los Angeles, 2003, pp. 268–271. Similar examples showing clocks on church towers or public buildings are Mâcon, Bibliothèque municipale, MS 1, Augustine, *De civitate dei*, fol. 33 (feast of Cybele, ca. 1480). New York, Pierpont

- Morgan Library, MS 232, fol. 112v and 157r (Bruges, ca. 1470).— Paris, BnF, MS Fr. 134, fol. 1 (presentation of the book).— Paris, BnF, MS Fr. 137, fol. 63r (battle between Phinée and Perseus).— Paris, BnF, MS Fr. 288, fol. 1 (presentation of the book).— Paris, BnF, MS Fr. 364, fol. 113r.— Paris, BnF, MS Fr. 2643, fol. 382r (coronation of Gregory XI).— Paris, BnF, MS Fr. 2644 fol. 1 (excution of Guillaume).— Paris, BnF, MS Fr. 2646, fol. 14v (Charles VI and Clement VII).— Paris, BnF, MS Fr. 9002 (Thierry nominates duke of Holland), fol. 28v.— Paris, BnF, MS Fr. 2257, fol. 58v (battle of Tyr).
- ⁶⁴ KATHRIN MÜLLER (cf. n. 26).
- ⁶⁵ Klaus Krüger bases his observations on an Italian panel showing the Fall of the Rebel angels. From a 'hovering' perspective beyond the earth, the beholder sees the angels falling towards the earth, looking upon the orb of the earth AND the celestial congregation with St. Michael from an elevated point of view located somewhere in the outer spheres in the panel of the Master of the Rebel Angels, c. 1340, Louvre. KLAUS KRÜGER, *Medium and Imagination. Aesthetic Aspects of Trecento Panel Painting*, in: Italian Panel Painting of the Duecento and Trecento, ed. VIKTOR M. SCHMIDT, New Haven 2002, pp. 57–81, here 71.
- ⁶⁶ Gerard of Cremona translated the *Almagest* by Ptolemy in 1175 from an Arabic translation made in Toledo. The treatise that was most important for spreading Ptolemy's ideas was Sacrobosco's *Sphaera*. See JEFFREY B. RUSSELL, *Inventing the Flat Earth. Columbus and Modern Historians*, New York, 1991, p. 19.
- ⁶⁷ GAUTIER DE METZ, *L'Image du Monde* (c.1245), ch. 15.
- ⁶⁸ For example in Paris, Bibliothèque Sainte Genieve, MS 2200, fol. 115v, William of Conches, *De philosophia mundi*, 1276–77, French school. The efforts to write encyclopedic texts addressing the structure of the cosmos (used for example for teaching at the universities) were inspired by Aristotelian ideas about the cosmos beyond the *Liber Floridus*, written in the third quarter of the twelfth century, and the *Hortus deliciarum* of 1175–1185, efforts that increased over the course of the thirteenth century. *Die Enzyklopädie im Wandel vom Hochmittelalter bis zur Frühen Neuzeit*, ed. CHRISTEL MEIER-STAUACH, Munich, 2002. For the illustrated manuscripts of Megenberg's translation, see ULRIKE SPYRA, *Das "Buch der Natur" Konrads von Megenberg. Die illustrierten Handschriften und Inkunabeln*, Cologne, 2005.
- ⁶⁹ Paris, BnF, MS Fr. 9140, fol. 159, Schéma(s) de cosmographie Barthélemy l'anglais (Bartholomeus Anglicus), *De proprietatibus rerum*, trans. Jean Corbichon, 1480.
- ⁷⁰ Paris, BnF, MS Fr. 567, fol. 3r and fol. 28r, God throning over the world, Brunetto Latini, *Livres du Trésor*.
- ⁷¹ London, British Library, MS Yates Thompson 31, fol. 66, Matfré Ermengau of Béziers, *Breviari d'Amour*, late 14th century.— Paris, BnF, MS Fr. 14970, fol. 48, Gautier de Metz, *L'Image du Monde*, 13th century.— Paris, BnF, MS Fr. 12469, fol. 71v.— Paris, BnF, MS Fr. 143, fol. 20, *Les Echecs amoureux* ('Amorous Chess'), made for Louise of Savoy, 15th century.— Paris, BnF, MS. Fr. 11972, Nicolas de Lyre, *Postillae*, 1450–1472.
- ⁷² Paris, BnF, MS Fr. 565, fol. 69, *Le livre du Ciel et du Monde*, trans. Oresme.
- ⁷³ Paris, BnF, MS Fr. 143, fol. 20.
- ⁷⁴ The importance of viewpoint is highlighted on comparison with the opening miniature of the Théroutanne *Trésor* (Paris, BnF, MS Fr. 567, fol. 3r), which shows two angels hovering next to an enthroned God firmly positioned upon a globe composed of eight concentric spheres, with the sun and moon floating between the spheres and the viewer.
- ⁷⁵ This attitude also led to intense enquiry into more terrestrial forms, such as bone structure, skull dimensions and the primrose.
- ⁷⁶ According to Bell, this perspective "first appears in the 15th century in Flanders and in Italy." JANIS C. BELL, *Zaccolini's Theory of Color Perspective*, in: The Art Bulletin 75/1, 1993, pp. 91–112,

here pp. 95–96. Another term used in art-historical scholarship is atmospheric perspective. For early examples in France and Flanders, see BETTINA PREISWERK, *Darkness in Illumination. Painting Techniques for Rendering Atmospheric Darkness in 15th-Century French and Burgundian manuscripts*, in: Manipolare la luce in epoca premoderna. Aspetti architettonici, artistici e filosofici, eds DANIELA MONDINI/VLADIMIR IVANOVICI, Mendrisio, 2014, pp. 217–233.

- ⁷⁷ Paris, BnF, MS Fr. 9140, fol. 191r, Barthélemy l'Anglais, *Livre des propriétés des choses*, 15th century.
- ⁷⁸ See the illumination of Christ on his way to Limbo in the four volumes of Lancelot du Lac and the Search for the Holy Grail, around 1470.— FRANÇOIS AVRIL/NICOLE REYNAUD, *Les Manuscrits a peintures en France 1440–1520*, Paris, 1993.
- ⁷⁹ DAVID SUMMERS 2007 (cf. n. 15), pp. 18–41 and DAVID SUMMERS 1994 (cf. n. 15), pp. 3–9. Summers has suggested that the "emergence of naturalism should not be understood as the inevitable consequence of progress in the arts, nor as a stage in an inevitable formal sequence, but as a complex set of pictorial inventions arising from meaning and immediately both amplifying and transforming meaning." DAVID SUMMERS, 1994 (cf. n. 15), p. 9.
- ⁸⁰ HANS BELTING (cf. n. 51).
- ⁸¹ ALBRECHT KOSCHORKE, *Die Geschichte des Horizonts. Grenze und Grenzüberschreitung in literarischen Landschaftsbildern*, Frankfurt am Main, 1990, pp. 49–69.— DETLEF ZINKE (cf. n. 11).
- ⁸² For a sophisticated overview of the representational plane, specifically, the creative tension between the notions of ground and the field (*Bildfeld/Bildgrund*), see WOLFRAM PICHLER, *Zur Kunstgeschichte des Bildfeldes*, in: Der Grund. Das Feld des Sichtbaren, eds MATTEO BURIONI/GOTTFRIED BOEHM, Munich, 2012, 441–474. He argues that the concept of the ground differs from that of the field inasmuch as the ground is based on notions of depth, while the field is based on horizontality. This field is distinguished by having boundaries; it can lie on a ground but is not equivalent to it. A field, Pichler argues, involve notions of position.
- ⁸³ MEYER SCHAPIRO, *On Some Problems in the Semiotics of Visual Art. Field and Vehicle in Image-Signs*, in: Semiotica 1/3, 1969, pp. 223–242.— For the Italian context and the argument of a fundamental difference between modern and Renaissance notions of pictorial composition, see THOMAS PUTTFARKEN, *The Discovery of Pictorial Composition. Theories of Visual Order in Painting 1400–1800*, New Haven, 2000.

LIST OF ILLUSTRATIONS

- Ill. 1–3, 6, 11: Historisches Museum Thurgau, Frauenfeld.
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SUMMARY

A curved marine horizon populated by a series of receding ships forms the background of a crucifixion scene on an altarpiece made around 1460 at the Upper Rhine. The scene testifies to the painter's familiarity with encyclopaedic tracts such as the widely read *Sphaera* written around 1230 by Sacrobosco. The consideration of the broader cultural and historical context for the altarpiece's unusual use of this background reveals how painters and illuminators of encyclopaedic manuscripts experimented, in the second half of the fifteenth century, with means of depicting the spherical cosmos within a largely square pictorial format. The Northern Alpine painter's use of colour perspective and close observation of nature is considered here in relation to ideas about the shape of the earth and the heavenly spheres that circulated in his day.

ZUSAMMENFASSUNG

Die Darstellung eines geschwungenen Meereshorizonts, der von einer Reihe sich entfernender Schiffe geziert wird, bildet den Hintergrund einer Kreuzigungsszene auf einem um 1460 am Oberrhein entstandenen Altarbild. Er zeigt die Vertrautheit des Malers mit enzyklopädischen Schriften wie dem um 1230 von Johannes de Sacrobosco verfassten, weit verbreiteten *Tractatus de Sphaera*. Die Betrachtung des breiteren kulturellen und historischen Kontextes für die ungewöhnliche Verwendung dieses Hintergrunds durch das Altarbild zeigt, wie Maler und Illuminatoren enzyklopädischer Handschriften in der zweiten Hälfte des 15. Jahrhunderts mit Mitteln zur Darstellung des sphärischen Kosmos innerhalb eines weitgehend quadratischen Bildformats experimentierten. Die Verwendung der Farbperspektive und die genaue Naturbeobachtung des nordalpinen Malers werden hier im Zusammenhang mit den Vorstellungen über die Form der Erde und der himmlischen Sphären betrachtet, die zu seiner Zeit kursierten.

RÉSUMÉ

Représenté sur un retable réalisé vers 1460 dans la région du Rhin supérieur, un horizon marin incurvé peuplé de bateaux sert d'arrière-plan à une scène de Crucifixion. Ce détail montre la familiarité que le peintre avait avec les manuscrits encyclopédiques tels que le traité *De sphaera mundi*, rédigé autour de 1230 par Johannes de Sacrobosco et lu par un large public. Un examen plus détaillé du contexte culturel et historique de l'emploi de cet arrière-plan, inhabituel pour un retable, révèle les expériences menées par les peintres et les enlumineurs de manuscrits encyclopédiques, durant la seconde moitié du XVe siècle, pour représenter le cosmos en forme de sphère à l'intérieur d'un format pictural généralement carré. L'utilisation de la perspective aérienne et l'observation attentive de la nature par ce peintre du nord des Alpes se rattachent ici aux idées qui circulaient, à l'époque, à propos de la forme de la Terre et des sphères célestes.

RIASSUNTO

La rappresentazione di un orizzonte marino curvilineo popolato da una serie di navi che si allontanano quale sfondo di una scena di crocifissione su una pala d'altare realizzata nella regione dell'Alto Reno intorno al 1460, mostra la familiarità del suo pittore con i testi enciclopedici come la diffusissima *Sphaera*, scritta intorno al 1230 da Sacrobosco. La considerazione del più ampio contesto culturale e storico per l'uso insolito di questo sfondo nella pala d'altare, rivela come, nella seconda metà del XV secolo, i pittori e i miniatori di manoscritti enciclopedici sperimentassero alla ricerca di modi per rappresentare il cosmo sferico all'interno di un formato pittorico per lo più quadrato. L'uso della prospettiva cromatica e dell'osservazione ravvicinata della natura da parte del pittore nord-alpino viene qui considerato in relazione alle idee sulla forma tanto del globo terrestre quanto delle sfere celesti che circolavano all'epoca.